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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

State Colorado

MINERAL REPORT

Mineral Patent Application of Wasatch Development Company

for the

Carbon Nos. 1-5 and Elizabeth Nos. 1-12 Oil Shale Placer Mining Claims

(Title)

LANDS INVOLVED

Garfield County, Colorado
T. 4 S., R. 97 W., 6th P.M.
Section 32: N½N½
Sections 33-36: All

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Denver, CO 80225

March 11, 1977
(Date)

By
Edwin H. Montgomery and
S. John Goldenstein
Mining Engineers

MAR 21 1977

Technical Review 3/18/77

Chief, Branch of Energy & Minerals

Management Review

Chief, Division of Resources

GPO 830-392

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I. Summary of Conclusions and Recommendations

We conclude that the subject claims do not meet the requirements of the mining law in the following respects and recommend that a contest be brought against the claims with the following charges:

A. The claims were not physically located on the ground prior to February 25, 1920, as required by Federal and State law.

B. The locators or claimants were not in diligent prosecution of work leading to a discovery of valuable oil shale on February 25, 1920, and did not continue in any such diligent prosecution to discovery.

C. There has been no discovery of a "valuable mineral deposit" on any of the claims; i.e., a prudent person would not expend his labor and means in an effort to develop a valuable mine on these claims.

D. As set forth in Union Oil Company of California, et al., 71 I.D. 169 (1964), the old contests against the claims were effective in cancelling the claims.

E. There was no substantial compliance with the assessment work requirements of the Mining Law.

F. The claims were abandoned from about 1930 to about 1957.

II. Introduction

This report is the result of a validity examination and should not be construed as being a complete engineering report for appraisal purposes or for purposes other than that for which the report is written.

A. Assumptions and Approach to Examination

The legal guidance set forth in the Regional Solicitor's memorandum of August 17, 1976, was used in preparing this report (see Appendix A).

It was assumed that every possibility of invalidity should be explored in our examination. Therefore, our report will take the approach of attempting to cover every alternative, even assuming that the Judge would rule against the Government on prior questions; or that the applicant could satisfactorily answer the question or supply the information needed. Thus, our report will cover the following questions:

1. Were the lands open to location at the time of location and discovery?

2. Assuming the answer to No. 1 is positive, was there evidence of fraud and/or use of dummy locators in the location?

3. Assuming the answer to No. 2 is negative, were the claims actually and properly located on the ground prior to February 25, 1920, or were they just "paper" locations?

4. Assuming the answers to Nos. 1, 2, and 3 are favorable to the claimant(s), were the "discovery" points as shown in the patent application actually found or relied upon by the locators or claimants prior to February 25, 1920?

5. Assuming the answers to Nos. 1 through 4 are favorable to the claimant(s), did the "discovery" points disclose deposits which, in themselves, constitute a valuable deposit of oil shale as of February 25, 1920, as of the present, and as of any time in between?

6. Were the claimants in diligent prosecution of work leading to a discovery of valuable oil shale on February 25, 1920, and did they continue in diligent prosecution of work to discovery?

7. What was the effect of the "old" contest decisions? (This involves legal conclusions beyond the scope of this report, but we will discuss charges, decisions, etc.)

8. If geologic criteria were used that the "Green River formation ....is one massive homogeneous deposit of like mineral, easily identifiable by fossil insects; that it is one stratum, one bed, from its base to its topmost reaches, a vertical distance of from 2,700 to 2,800 feet; that all sections of a stratigraphic column of this formation contain either shale, sandy shale, shale sand, or sand that will yield oil upon destructive distallation; that in the light of latest information and engineering research and opinion the feasible method of mining will involve and dictate the mining of all the shale from the base of a rich bed, known as mahogany bed, to the exposures of shale upon the land; that the various deposits of sandstone upon the land in question are but thin partings, which have some oil content; that the whole body, therefore, will be commercially developed and is all valuable, and discovery of any oil shale upon the land, being a part of the integral mass that lies below it, is a sufficient discovery to satisfy the requirements of law", could the rich underlying oil shale be considered a valuable mineral deposit as of February 25, 1920, as of the present, and as of any time in between?

9. Was there substantial compliance with the assessment work requirements of the Mining Law?

10. Were the claims abandoned at any time?

B. Definition of "Oil Shale"

1. Prior to February 25, 1920

a. Woodruff and Day, in USGS Bulletin 581A, 1914, "Oil Shale of Northwestern Colorado and Northeastern Utah," do not define oil shale. They equate oil shale with "highly bituminous shale". (p. 1)

b. Dean Winchester in USGS Bulletin 641-F, 1916, did not define oil shale. Resources were calculated on beds more than three feet thick and containing more than 24.6 gpt (p. 141). Samples were assayed that yielded as low as 0.31 gpt; however, 40 out of 57 samples yielded more than 10 gpt.

c. M. J. Gavin, et al., in Bureau of Mines publication dated May 1, 1919, entitled "Notes on the Oil Shale Industry, with Particular Reference to the Rocky Mountain District" also do not define oil shale. They do equate "oil shale" and "bituminous shale" (pp. 1 & 2). They also state "oil shale occurs in beds or strata ranging from a few inches to several feet, and its yield of oil ranges from practically nothing to 90 gallons or more per ton." (p. 2)

2. At Time of Patent Application

One possible source of information is an undated report by Irvin Nielsen, Geologist, employed by the Wasatch Development Company in the 1950s entitled "Discoveries on Oil Shale Placer Mining Claims". In that report he apparently called everything which assayed even a trace as "oil shale". The logs of assaying core hole samples accompanying the report use three categories: trace, less than 1 gpt, and more than 1 gpt. The report apparently was written shortly after the drilling by Wasatch Development Company, probably in the period 1958-1960. A copy of the report was given to us by a representative of Carter Oil Company (See Appendix B).

3. Recent Times

The word "oil shale" has had many different definitions in recent times:

a. John Ward Smith, P. 73, Guidebook To The Energy Resources Of Piceance Creek Basin, Colorado, 1974----"The name oil shale is not a lithologic (rock type) name but an economic name referring to the rock's ability to yield oil."

b. Trusdell, et al., p. 2, U.S. Bureau of Mines, RI 7357, 1970--Oil shale is used as a rock type.

c. John Ward Smith and Howard B. Jensen, p. 1 of article entitled "Oil Shale" for McGraw-Hill's Encyclopedia of Science and Technology, 1976, contains this somewhat contradictory definition: "A sedimentary rock containing solid, combustible organic matter in a mineral matrix. The organic matter, often called kerogen, is largely insoluble in petroleum solvents, but decomposes to yield oil when heated. Although "oil shale" is used as

a lithologic term, the name is actually an economic term referring to the rock's ability to yield oil. No real minimum oil yield or content of organic matter can be established to distinguish oil shale from other sedimentary rocks. Additional names given to oil shales include black shale, bituminous shale, carbonaceous shale, coaly shale, cannel shale, cannel coal, lignitic shale, torbanite, tasmanite, gas shale, organic shale, kerosene shale, coorongite, maharahu, kukersite, kerogen shale, algal shale, and others."

d. In the United States v. Frank W. Winegar, et al., 81 I.D. 370-1974, 16 IBLA 130, IBLA 70-549, oil shale was defined as:

> "....Oil shale is a fine-grained, laminated, sedimentary rock containing solid organic material called kerogen which, upon destructive distillation, will produce a substantial amount of oil. The kerogen is derived from deposition of aquatic plants and smaller amounts of animal life in lakes during various geological periods. Oil shale does not contain appreciable amounts of (free) oil.
>
> "Oil shale was deposited in a wide span of the earth's geological history from the Cambrian to recent periods. Shale deposits that yield at least 10 gallons of oil per ton occur in all of the continents. There are both high and low grade oil shale deposits in Africa of late Paleozoic and early Mesozoic age. In the Stanley Basin of the Congo, entensive deposits of oil shale of Triassic age exist in beds that aggregate about 30 feet in thickness and yield more than 25 gallons of oil per ton. There are extensive deposits in China, Israel, Jordan, Syria, Siberia, Thailand, Burma, and Turkey. The oil shale resources of Asia have been estimated at 70 billion barrels in deposits that yield more than 25 gallons per ton. Deposits occur in Australia and New Zealand. The known higher grade deposits are estimated to contain 280 million barrels oil equivalent.
>
> "In Europe there are substantial oil shale deposits in the Balkan Peninsula and adjacent area, France, Germany, Great Britain, Italy, Switzerland, Luxembourg, Russia, Spain, Portugal, and Sweden. The recoverable oil shale resources of Europe are estimated to contain a total of more than 30 billion barrels, mostly in shales that yield more than 25 gallons per ton. In South America, oil shale deposits are known to exist in Argentina, Brazil, Chile, and Uraguay. These oil shale resources are estimated to contain 50 billion barrels of recoverable shale oil.

> "In the United States, deposits of oil shale of varying nature and extent have been reported in the States of Alabama, Alaska, Arkansas, California, Colorado, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Missouri, Michigan, Montana, Nevada, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming. 1/ A large fraction of shale deposits of the United States contain small amounts of organic matter which will yield from one to five gallons of oil per ton on destructive distillation. These rocks have not been considered as oil shale. In addition, some sandstones, siltstones, and limestones contain solid organic matter which yield very small amounts of oil. Possibly half or more of the sedimentary rock areas of the country will yield a small amount of oil. Oil shale can, therefore, be subject to several definitions. One authority defines oil shale as organic-rich shale that yields at least 10 gallons (3.8) percent of oil per ton." 2/

If "oil shale" is an economic term, then some minimum grade or cutoff can be established. One possibility is to use the point at which energy output equals energy input. According to John Ward Smith (personal communication, 1976), the energy used for retorting approximates the energy obtainable from two gallons per ton shale. According to the Rio Blanco Oil Shale Project's Detailed Development Plan, the total energy input (including mining, crushing, retorting, etc.) approximates the energy obtainable from eight gallons per ton shale. Therefore, resources of shale below eight gpt or less than ten feet thick were not calculated (Vol. 1, Sec. 3, Page 3-3-63).

R. T. Chew, formerly of Occidental Petroleum Corporation (OXY), stated that mined rock that contained about 10 gal/ton of oil "....is considered to be below the cutoff point for marketable ore; it must be stored in a local canyon." (Rocky Mountain Association of Geologists, "Guidebook to the Energy Resources of the Piceance Creek Basin, Colorado," 1974.) OXY uses an in situ process that involves mining to provide access to retort chambers and to create void space for in situ recovery.

1/ See USGS Bulletin 641-L, "Oil Resources of Black Shale of the Eastern U.S.", 1917.

2/ Duncan and Swanson, USGS Circular 523, "Organic Rich Shale of the U.S. and World Land Areas", 1965, p. 3.

Ten gallons per ton is the minimum value shale for which resources are computed by the Geologic Division of the U.S. Geological Survey. In this computation, shale averaging less than five gpt in intervals of ten or more feet thick were excluded.

The Conservation Division of the U.S. Geological Survey presently uses a minimum average of 15 gpt over a minimum thickness of 15 feet in classifying lands as oil shale lands and is considering lowering this to 10 gpt over 10 feet (Dan Jobin, Area Geologist, Conservation Division, USGS, personal communication, 1976).

4. As Used in This Report

We do not believe that material assaying extremely low grades can be considered "oil shale". Further, as indicated above, many sedimentary rocks contain small amounts of carbonaceous material that will yield oil.

The figure of 8 gpt used by one of the oil shale lessees makes sense to us, since it is based on energy input versus energy output. This is not to say that any grade above 8 gpt has any present economic value. Also, low-grade oil shale (even if over 8 gpt) of less than a mining thickness of, say, 10 feet, has no future potential value worth considering in further analysis.

Therefore, for the purposes of this report, we will call rock yielding more than eight gpt "oil shale" and any bed yielding more than eight gpt and ten or more feet thick will be given further consideration in terms of technical and economic analyses.

The tongues of the Green River formation which outcrop on the claims and which assay less than eight gpt will be called marlstones rather than oil shale. However, whatever definition is used would probably make no difference on these particular claims.

C. Other Definitions and Abbreviations Used

Yield or Fischer assay will be reported as "gpt" which means gallons of shale oil per short ton of shale.

III. Record Data and Past History of Claims

A. Lands and Claims Involved

The claims cover all of Sections 33-36, and the N½N½, Section 32. T. 4 S., R. 97 W., 6th P.M., Garfield County, Colorado. Specifically, the claims cover the following subdivisions:

Name of Claims	Subdivision	Acreage
Elizabeth No. 1	S½S½, Sec. 36	160
" 2	N½S½, Sec. 36	160
" 3	S½N½, Sec. 36	160
" 4	N½N½, Sec. 36	160
" 5	N½N½, Sec. 35	160
" 6	S½N½, Sec. 35	160
" 7	N½S½, Sec. 35	160
" 8	S½S½, Sec. 35	160
" 9	S½S½, Sec. 34	160
" 10	N½S½, Sec. 34	160
" 11	S½N½, Sec. 34	160
" 12	N½N½, Sec. 34	160
Carbon No. 1	S½S½, Sec. 33	160
" 2	N½S½, Sec. 33	160
" 3	S½N½, Sec. 33	160
" 4	N½N½, Sec. 33	160
" 5	N½N½, Sec. 32	160
TOTAL.......................................		2,720 Acres

B. Location Data

The recorded location certificates disclose the following: The Carbon 1-5 inclusive group was located April 10, 1918, by Jack Montgomery, E. E. Fordham, F. N. Juhan, Elizabeth Juhan, Winnifred Fordham, Genevieve Fordham, Hope Cleveland, and Joe Juhan. The Carbon 1-4 inclusive are recorded in Book 115, pages 554-556, April 12, 1918, in the Garfield County records.

The Elizabeth group was originally located as the Elizabeth J. group, and is now called the Elizabeth group by the applicant. The Elizabeth J. 1-8 inclusive were located May 18, 1918, by F. N. Juhan, Elizabeth Juhan, James E. Ford, Mabel M. Ford, Georgia May Williams, E. L. Williams, Joe T. Juhan, and Doris Ford. The location certificates were dated June 10, 1918, and filed June 12, 1918, in Book 118, pages 31-35 inclusive in the Garfield County records.

The Elizabeth J. 9-12 inclusive were located May 18, 1918, by F. N. Juhan, Elizabeth Juhan, James E. Ford, Mabel M. Ford, E. E. Fordham, Genevieve Fordham, Winnifred Fordham, and Joe Juhan. The certificates were dated June 10, 1918, and were also filed June 12, 1918, in Book 118, pages 35-37 inclusive in the county records of Garfield County, Colorado.

C. Other Locations by Some of the Same Locators

During the period December 1917 to June 1918, Elizabeth Juhan, F. N. Juhan, and Joe T. Juhan located the following numbers of oil shale claims (including the Carbon Nos. 1-8 and Elizabeth Nos. 1-12):

December 1917	12, 12, 12
January 1918	4, 4, 4
February 1918	37, 37, 37
March 1918	51, 95, 51
April 1918	119, 119, 38
May 1918	14, 30, 14

D. Land Status

Although the land was classified as valuable for nitrogen and petroleum in 1916, it remained open to the location of oil shale mining claims until the passage of the Mineral Leasing Act on February 25, 1920. EO 5327 of April 15, 1930, withdrew, under provisions of the Pickett Act, the oil shale lands in Colorado from lease or other disposal, subject to valid existing rights, and reserved them for investigation, examination, and classification.

The Act of February 28, 1931, permitted entry for Stock Raising Homesteads on lands withdrawn by EO 5327, but continued to reserve all minerals to the United States. EO 6016, February 6, 1933, modified EO 5327 to allow oil and gas permits and leases on any lands withdrawn by EO 5327. EO 7038 of May 13, 1935, further modified EO 5327 to allow sodium permits and leases on lands withdrawn by EO 5327.

On September 19, 1934, the subject lands were withdrawn to conserve and develop Indian lands and resources and for other purposes. This withdrawal was revoked effective January 31, 1939, by Secretarial Order of December 8, 1938, restoring the lands and minerals to use and disposition as provided by law.

P.L. 250 (67 Stat. 539), passed August 12, 1953, allowed mining claims located after July 31, 1939, and before January 1, 1953, on lands known to be valuable for Leasing Act minerals, to be validated by filing an amended location certificate in the proper county recorder's office.

P.L. 585 (68 Stat. 708), the Multiple Mineral Development Act of August 13, 1954, allowed validation of mining claims located after December 31, 1952, and prior to February 11, 1954, by filing an amended location certificate in the proper county recorder's office. This Act provided that mining claims could be located after August 13, 1954, on lands known to be valuable for Leasing Act minerals. This, in effect, opened the oil shale lands to location of claims for metalliferous minerals.

P.L. 167, the Multiple Use Act of July 23, 1955, amended the Materials Act of 1947 to prohibit the location of mining claims for deposits of common varieties of sand, stone, gravel, pumice, pumicite and cinders.

An application for withdrawal of oil shale lands in Colorado was noted on the Land Office records on January 27, 1967. Subsequently, PLO 4522

of September 23, 1968, withdrew lands in the Piceance Creek Basin, along with other oil shale lands, from location of metalliferous minerals, and from sodium leasing except as specified by the order.

The surface of the E½W½ and W½E½ of Section 33 was patented November 5, 1924 (Glenwood Springs 019046, Pat. 947444) under the provisions of the Act of July 17, 1914; and the E½SE¼, Section 33, was patented (Glenwood Springs 019047, Pat. 947443) under provisions of the Act of December 29, 1916, to Henry Adams Howe. Apparently there were no objections to these patents.

The land has been leased for oil and gas in the past. The Federal land is presently under grazing permits and has some rights-of-way granted. Also, a pipeline ROW application and oil and gas lease applications have been filed on some of the land.

E. Record History

It is believed that most, if not all, of the locators were related. Shortly after the locations, the claims were conveyed to H. C. Wolf. There are a number of questions raised by the record data:

---Three of the quitclaim deeds were notarized before the date on the deeds.

---In two of the quitclaim deeds, full title to the claims were purportedly conveyed to H. C. Wolf by one of the locators before they had been conveyed to him. However, this was corrected in later QCDs.

---The investigation and reports by C. R. Bradshaw on the Carbon Nos. 5-8 claims indicate that dummy locators were strongly suspected, but could not be proved.

After a series of title transfers, H. Comer Wolf, Lewis Z. Harrison, Leon Levy, Sam Levy, Joseph B. Umpleby, and Amos F. Keene, applied for patent to the Carbon Nos. 5-8 claims during 1925 (Patent Application No. Glenwood Springs 026229, Denver 035626). The Final Certificate was issued January 9, 1926. In following actions, the Carbon Nos. 7 and 8 were patented (No. 1055842), Carbon No. 6 was contested for lack of discovery (Contest 11695), and after a hearing, was declared null and void. Carbon No. 5 was rejected for patent as it was no longer contiguous with Carbon Nos. 7 and 8.

The original quitclaim deed from Mrs. Comer Wolf to Wasatch Development Company and the forfeiture procedures included the Carbon Nos. 5-8 (Patent had been issued to Nos. 7 and 8, Carbon No. 6 had been declared null and void for lack of discovery.). In a quiet title action, the Colorado State Court of Garfield County granted title to Carbon Nos. 5 and 6, but not to Nos. 7 and 8. The applicant did not include the Carbon No. 6 claim in the subject application for patent.

The final certificate for Carbon Nos. 5-8 was dated January 9, 1926, and recorded on January 16, 1926, and the claims were entered on the tax rolls of Garfield County. The claims, both patented and unpatented, were sold to R. F. Magor, Jr., for taxes by Tax Sale Certificate (Abstract #49), dated December 14, 1927, and Treasurer's deed (Instrument #59), dated March 29, 1940. The question of whether the title to Carbon No. 5 remains in the heirs of R. F. Magor, Jr., or went in the quiet title action in which Magor was not a party, should be clarified.

On May 27, 1957, Mrs. B. M. Wolf, aka Mrs. H. Comer Wolf, widow of H. Comer Wolf, quitclaimed her interest in the Carbon Nos. 1-8 and the Elizabeth Nos. 1-12 mining claims to the Wasatch Development Company for $500.00 for each group of claims ($0.39 and $0.26 per acre). Wasatch Development Company did the assessment work for 1957, then proceeded with forfeiture procedures to clear title to the claims. Apparently Joseph B. Umpleby contributed his share of the costs. Wasatch began proceedings in Colorado State Court (C. A. 5098), Garfield County, for a quiet title action to all 20 claims. The Court issued a decree on May 1, 1959, granting title to Wasatch Development Company and Joseph B. Umpleby to the Elizabeth Nos. 1-12 and Carbon Nos. 1-6 mining claims. The Wasatch Development Company filed an application for patent (C-030979) for Elizabeth Nos. 1-12 and Carbon Nos. 1-5 on September 15, 1959.

Carter Oil Company, a subsidiary of EXXON, Inc., claims title to the claims and has background material on the claims, but has not made this a matter of record in the land records.

Assessment work or in lieu notices were recorded for all the claims as follows:

---Notice in lieu dated December 28, 1919, for 1919, Book 119, page 537.

---Notice of Intent to Hold Mining Claims dated June 27, 1921, Book 130, page 505.

---Affidavit of Labor dated June 30, 1921, states work commenced July (June?) 22, 1921 (1920?), for the year ending December 31, 1920, filed July 1, 1921, Book 130, page 507.

---Affidavit of Labor dated June 30, 1922, for year 1922, filed by Leonard Baird, Book 138, page 144.

---Affidavit of Labor dated October 10, 1922, for year 1920, filed by W. J. Black, notarized in Oklahoma, filed October 27, 1922, Book 134, page 578.

---Affidavit of Labor dated June 30, 1923, for period July 1, 1922, to July 1, 1923, filed by J. D. Freeman, Book 141, page 154.

---Affidavit of Labor dated June 28, 1924, for period July 1, 1923, to June 30, 1924, filed by George H. Willard.

---Affidavit of Labor dated January 6, 1925, for period July 1, 1924, to December 31, 1925 (1924?), filed by H. J. Hilton, Book 147, page 130 (Carbon No. 5 not included).

---Affidavit of Labor dated June 6, 1925, for period July 1, 1924, to December 31, 1924, filed by H. J. Hilton, Book 147, page 129 (Carbon Nos. 5-8 claims only).

---Affidavit of Labor dated July 1, 1926, for year 1925, filed by F. A. Goodale, Book 147, page 538 (Carbon No. 5 not included). However, a Final Certificate had been issued for the Carbon 5-8 claims on January 9, 1926.

The next assessment work notice was filed in December 1957, covering work done between May 1 and November 1, 1957. Apparently no assessment work affidavits have been filed through 1973 (as checked by the former Oil Shale Project title clearance group), although we did not check on this.

F. Prior Contests

1. Carbon Nos. 1-4 and Elizabeth Nos. 1-12 Claims

Adverse proceedings against the Carbon Nos. 1-4 inclusive, and the Elizabeth J. Nos. 1-12 inclusive, charging that no assessment work was done for the period of July 1, 1927, to July 1, 1928, respectively, were instigated by letter "N" UEG (1326846, Contest 12029) of May 28, 1929, by the Commissioner of the General Land Office. The claimants answered stating the claims were not abandoned but admitting the charges and contending that assessment work was unnecessary as far as the United States was concerned, and the charge was ordered amended by office letter "N" of June 4, 1930. Amended adverse proceedings were directed as follows:

> "That annual assessment work to the value of $100 was not performed upon each and any one of the Carbons 1-4 inclusive, Elizabeth J. 1-12 inclusive, oil shale placers for the year ending July 1, 1929, and work has not since been resumed".

The charges were served on the parties of interest June 12, 13, and 16, July 30, 1930, and March 30, 1931, and an answer was filed admitting the charge but contending assessment work was unnecessary as far as the United States was concerned. This was rejected by the Department Decision of November 29, 1930, A-15072. The claims were declared null and void by letter in 1931. This decision and the service involved in the contest action was found to be effective in Union Oil Company of California, et al., 71 I.D. 169, 1964.

2. Carbon No. 5 Claim

After examination of the Carbon Nos. 5-8 claims by G. M. Kintz in connection with Mineral Patent Application Glenwood Springs 026229, later Denver 035626, a complaint dated June 23, 1927, was sent out against all the claims under Contest 1894, later Contest 11695, charging:

a. Lack of valid discovery prior to February 25, 1920.

b. Failure to do assessment work.

After several re-examinations, and after the Freeman v. Summers and Krushnic decisions, charges against the Carbon Nos. 5, 7, and 8 claims were dropped. The Carbon Nos. 7 and 8 claims were allowed to go to patent (No. 105842). The Carbon No. 6 was rejected for lack of discovery and declared null and void by GLO Commissioner's decision of April 23, 1943. The Carbon No. 5 was rejected from the patent application because of noncontiguity. Wasatch Development Company filed patent application C-031084 for the Carbon No. 6 claim in the late 1950s. This was finally rejected by Departmental Decision A-28674 dated May 16, 1963.

G. Actions Since Filing of Patent Applications

After the patent application was filed in 1959, the following significant actions have taken place:

1. On March 8, 1960, the applicants amended their application to exclude the Elizabeth No. 3 claim, apparently as a result of Kuehnel's report showing no discovery on that claim.

2. By decision on March 29, 1961, the Hearings Examiner dismissed P.L. 585, Sec. 7, proceedings (Contest D-055619 (582:21) against the Elizabeth Nos. 4-8 claims in Sec. 35 based upon a stipulation between the oil and gas lessee and the claimants.

3. On February 16, 1962, the application was rejected as to the Carbon Nos. 1-4 and Elizabeth Nos. 1, 2, and 4-12, based on the old contest proceedings, and the failure of the applicants, or their predecessors, to object to the 1931 decision (principles of finality of administrative action and res judicata).

4. Thereafter, the claims became involved in the so-called TOSCO case, U.S. v. TOSCO, et al., recently remanded to the U.S. District Court, Colorado District, by the U.S. Court of Appeals, Tenth Circuit (74-1344). The original of the patent application file, along with the many other documents associated with the case, are in the custody of the Clerk of the U.S. District Court.

The following excerpt from Synthetic Fuels, September 1976, summarized the history and status of the case:

Civil Actions 8680 Secretary of Interior v. TOSCO
8685 Secretary of Interior v. Umpleby-(Subject Case)
8691 Secretary of Interior v. B. T. Napier
9202 Secretary of Interior v. P. C. Brown

10th Circuit Court of Appeals decision of 2/4/69 upheld District Court decision that Appellee's claims cannot be adjudged invalid for failure to perform assessment work. Case appealed to U.S. Supreme Court 10/69. Supreme Court essentially reversed lower court decision 12/70 and remanded case to U.S. District Court. (See March 1971 issue of Synthetic Fuels, page 1-1 for details of U.S. Supreme Court decision.) Another District Court decision was issued on 12/19/73, which said that Interior cannot deny patents on the basis of old contest proceedings. BLM must now reprocess patent applications using fraud, abandonment, and discovery as issues in determining the validity of claims.

Final judgement entered on 3/15/74. Interior filed notice of appeal on 5/14/74. See June 1974 issue of Synthetic Fuels, page 2-4 for details. Appeal is now before the 10th Circuit Court of Appeals in Denver as Case No. 74-13-44. See discussion under the heading of U.S. 10th Circuit Court of Appeals on page 2-20 of the December 1975 issue of Synthetic Fuels. The Order of Remand was reproduced in the Appendix section of the December issue. Both Appellees and Appellants petitioned for rehearing, and the petitions were placed before a panel of three judges of the 10th Circuit Court of Appeals. The panel of judges denied the rehearing and the parties were given time to file a Writ of Certiorari. On 4/9/76, a Writ of Certiorari was filed with the U.S. Supreme Court (SCOTUS). SCOTUS gave the No. 75-1436 to the writ. SCOTUS denied the writ and remanded the matter to the U.S. District Court in Denver on 6/21/76.

H. Summary of Numbers Related to Claims: See Table 1

IV. General Information on Area

A. Location and Access

The claims are located about 25 miles airline west-northwest of Rifle, Colorado. They can be reached by taking State Highways 13 and 789 from Rifle to Rio Blanco, thence northwesterly on paved Rio Blanco County roads along Piceance Creek for either approximately 17 miles to Stewart Gulch or 20 miles to Willow Creek. The dirt roads up West Fork of Middle Fork, Stewart Gulch, provide access to the east end of the group of claims (Elizabeth Nos. 1-4); whereas, the West Fork, Stewart Gulch, provides

TABLE 1

Summary of Numbers Related to Claims

Name of Claim	Field Division (F.D.) Number	Contest Number	Case File Number	Other Numbers
Elizabeth No. 1	37502 1/	12029	M.A. C-030979	(Misc. No) 1326846
" 2	37503	"	"	"
" 3	37504	"	"	"
" 4	37505	"	"	"
" 5	37506	"	"	"
" 6	37507	"	"	"
" 7	37508	"	"	"
" 8	37509	"	"	"
" 9	37510	"	"	"
" 10	37511	"	"	"
" 11	37512	"	"	"
" 12	37513	"	"	"
Carbon No. 1	37514	"	"	"
" 2	37515	"	"	"
" 3	37516	"	"	"
" 4	37517	"	"	"
" 5	37518	11695	" 2/	"
" 5	41693			
" 5	4267 1/			

1/ Key file.

2/ Previously in Patent Application Glenwood Springs 026229, later changed to Denver 035626.

TABLE 1: Summary of Numbers Related to Claims

access to the middle of the group. East Fork, Willow Creek, and Bull Fork of the East Fork, provide access to the west end claims (Carbon Nos. 1-5). In addition, the claims are linked by roads, mostly east-west, along the divide between the Piceance Creek drainage and the West Fork, Parachute Creek. There are also roads or trails on most of the ridges between the various forks of Willow Creek and Stewart Gulch.

The dirt roads are private roads crossing private lands, but are generally open except during hunting season. The roads may be impassable during wet weather and are generally closed in winter because of snow. The existing roads can not be used for any extensive development without considerable upgrading.

B. Physical Features

The claims are generally located on the divide between the Piceance Creek drainage (draining into the White River) and the Parachute Creek (draining into the Colorado River). Therefore, their elevation is quite high compared to much of the Piceance Creek Basin, varying from under 7600 to over 8520 feet above sea level. This compares with the elevation at Rifle of 5,400 feet.

The topography varies from gently rolling ridge tops to steep-sided valleys. Relief is generally several hundred feet to as much as 800 feet.

There are some springs in the area, notably on the old Howe homestead in Section 33 on Willow Creek, and in the West Fork, Parachute Creek (Summer's Homestead--off these claims).

Other than the snow melt in spring and early summer, the only live water on the claims is the small amount in Willow Creek from the springs mentioned above.

C. Climate

The weather varies from warm and dry in the summers with occasional thunderstorms to extremely cold winters. From mid-spring to mid-fall the thunder and lightning storms occasionally release heavy rains that sometimes result in flash floods. Winter snows usually close the area to all use and travel until some time in April. Following an open winter, the area can be reached as early as March, but heavy winter snows may keep the area closed until May and local snow patches until early June.

D. Vegetation

The vegetation varies with sagebrush and native grasses present over most of the area. The south slopes and upper ridges also have a growth of brush, mainly scrub oak, service berry, and similar types. The north slopes of higher elevations are often covered by aspen groves. The valley bottoms are meadow where there is sufficient moisture.

E. Railroads, Power, Water, Etc.

The nearest railroad (Denver and Rio Grande Western) passes through Rifle along the Colorado River. The nearest airports are at Rifle and Meeker, Colorado, but Grand Junction is the closest with scheduled airline service.

Telephone service and power lines are available along Piceance Creek but are inadequate for any large commercial or industrial use.

Water for any extensive oil shale development would have to be transported into the area.

F. Land Uses in the Area

The only permanent industry in the area is the livestock industry which uses the area of the claims for grazing. Hay is harvested along the lower parts of Stewart Gulch, Willow Creek, and Piceance Creek.

The Piceance Creek Basin is used for hunting, both large and small game. The largest migratory deer herd in the state winters in the Piceance Creek Basin.

G. Maps and Photographs Covering Area

1. Topographic and Geologic Maps (USGS):

Cutoff Gulch--1:24,000 (Geologic--MF 691)
Bull Fork-----1:24,000 (Geologic--in press)

2. Land Ownership Maps (BLM)---Scale ½" = 1 Mile:

Meeker (NW-14)---shows access from Piceance Creek
Rifle (NW-20)----covers area of claims

3. Other

BLM Maps---Status of mining claims on oil shale lands, ½" = 1 mile
Also ¼" = 1 mile.

4. Aerial Photographs

Commodity Stabilization Service:

DXN-4N-130, 143 (1954) (1:8000 approximately)
DXN-9N-22 (1954)

GS-VCND (1-48 to 1-87) (1970) (1:24,000)
BLM-F16CN-08-45 (773-66 to 773-71) and (773-124 to 773-129)
(1973) (1:24,000) Color

V. Investigations and Field Work

A. Previous Investigations

1. 1920s

a. All Claims Except the Carbon No. 5

Louis A. Mackel examined the claims in 1928. Mackel's report was dated January 9, 1929. In the report he stated that a valid discovery of mineral had been made (this was after the Freeman v. Summers decision). There was no discussion of the actual mineral showings nor of the reasons for reaching that conclusion. Most of the report was detailed estimates of the cuts (valued at from $619 to $1,236 per claim). Mackel recommended adverse proceedings based on failure to do assessment work during certain years. Mackel stated that conditions on the subject claims were similar to those involved in the Carbons 5-8. Elsewhere in the file (F.D. 37502), there is the statement (possibly by O. J. Berry) that the same failure to locate the claims on the ground applied to these claims as to the Carbon Nos. 5-8. In fact, the affidavit by the Howes in the Carbon Nos. 5-8 file refers specifically to the lands covered by these claims--two or three miles surrounding the Howes' homestead in Section 33.

In the record on Contest 11695, there is a stipulation, dated March 14, 1932, signed by the attorneys for the contestees that the first cut on the Carbon No. 6 was done in the spring of 1924. C. R. Bradshaw made investigations as to the bona fides of the claims, and as to when the cuts were dug, which are set forth in reports dated 5/16/27 and 10/17/27. These investigations strongly indicate that:

(1) The claims were not located on the ground prior to February 25, 1920. (However, it should be noted that Mr. Joe T. Juhan testified in the hearing on the Carbon No. 6 that, in the spring of 1918, he located and staked, and made discoveries on the claims.)

(2) The cuts were dug well after 1920, possibly as late as 1923 or 1924. Henry Adams Howe's affidavit states that one hole was dug in dirt in the SW¼NW¼, Section 34 (Elizabeth No. 11 claim) in 1921. See also memo in file re O. J. Berry being on claims in 1920 and seeing no work on claims.

b. Carbon No. 5 Claim:

The Carbon No. 5 claim was examined in connection with the patent application for the Carbon Nos. 5-8 claims (Glenwood Springs 026229, later changed to Denver 035626). It was examined by G. M. Kintz in 1925,

and the report was dated 3/31/27. Kintz described the cuts on claim No. 5 as to dimensions, value, year apparently done, and estimated grade. He estimated the grades at from barren to 12 gpt. In cut #5, he described the rock as follows: "Solid light brown massive shale about 6-12 gallons to the ton, sufficient for discovery" (p. 3). However, later he says, "There is not exposed on this claim by visual observation any shale that will run one foot in thickness and 15 gallons to the ton. Therefore, adverse proceedings are recommended on the ground, there is no discovery upon this claim (p. 4)." Later in his report, he said he took a sample between holes 4 and 5 (present "discovery" between cuts 3 and 4) and assayed it himself. The sample was over a thickness of 21 inches and assayed 7.8 gpt (p. 14), which, he said, was insufficient for discovery.

In 1927 Geo. G. Bywater re-examined the claims (report dated January 3, 1928) using Freeman v. Summers criteria, and found that each claim had a valid discovery. However, he noted that the surface showings have no value in themselves and would never be worked. He also stated that the cuts were dug in 1923 and 1924 and questioned the advisability of allowing the work as improvements toward development of the claim.

In 1931 the claims were again examined, this time by Wade V. Lewis and Perry Williams. They took a four-foot sample from cut #5 which assayed 13 gpt. They said that with this showing and with natural outcrops occurring on the claim, they recommended dropping the "no discovery" charge. This was done.

2. 1950s and 1960s

After patent application C-030979 was received on September 8, 1959, Frank Kuehnel, Valuation Engineer, examined the claims during October and November of 1959. He was accompanied by Tom Walker, Surveyor, and Irvin Nielsen, Geologist. His report was submitted on February 25, 1960. The only sample he had assayed was from the Elizabeth No. 3 claim, and the results were no oil. He recommended the Elizabeth No. 3 be contested for lack of a discovery and that the others be approved for patent, based on visually estimated values of oil shale, and based on the Freeman v. Summers criteria.

Warren Sholes, Valuation Engineer, examined the Elizabeth No. 3 claim during November 1959, along with Frank Kuehnel, but did not write a report.

During September 1962, Daniel Y. Meschter, Geologist, and James F. McIntosh, Mining Engineer, examined the claims. Meschter and McIntosh took samples at the discovery-point outcrops or in adjacent pits. Except for one sample, these were grab samples taken at the surface without doing any excavation work. The samples were assayed at the Bureau of Mines Laboratory at Laramie, Wyoming. The values varied from none to 8.0 gpt, but were mainly under 2.5 gpt. Meschter submitted his report on March 13, 1963, and recommended that all the claims be contested for lack of sufficient discovery.

On January 16, 1964, James F. McIntosh submitted his report on the claims based on his field work with Dan Meschter and using the same samples and assays. He recommended the claims be contested charging that no discovery of valuable minerals had been made, and that the claims were not located and were not being held in good faith for mining purposes.

3. Present Investigation

We, Edwin Montgomery and John Goldenstein, both Mining Engineers, examined the mining claims on May 18-20, June 2-4, 7-11, 21-25, 28-30, July 1, 13-16, 1976. Sampling started on June 23 and continued, with interruptions, through July 16.

Section and quarter-corner brass cap survey monuments (1938) were found and used to identify the area along with 7½' topographic maps. All but about two of the cuts made during the 1920s were found and examined. Most had sluffed in badly and vegetation is being or has been re-established. The discovery points of Tom Walker apparently had been marked with a lath and survey stake. Most had fallen down and some were gone, but many were found. Samples were taken at adjacent outcrops or, in some instances, the closest pit or recent bulldozer cut. Sample points were dug back to solid rock, in places often requiring considerable digging (see photographs). Chip or channel samples were taken.

Ideally, the best way to obtain accurate information would have been to drill through the marlstone tongues near the discovery points. Because most discovery points are on steep hillsides, this would have required considerable trail building and the use of an expensive drill and water truck. Also, such exploration is not the responsibility of the BLM mineral examiner.

We decided the next best approach was to attempt, if possible, to get a sample of a mineable thickness (about 10 feet) in the vicinity of the "discovery" point. It was not possible to get into completely unweathered rock in every case; however, surface weathering was removed before sampling. To get to completely unweathered rock would have required several days work per sample point, which was not possible and which is the responsibility of the claimant.

The objective of the sampling was to obtain a representation or approximation of the possible mining thickness (minimum 10 feet) of the best known material exposed on the claim, if possible. Samples were also taken of selected layers to get indications of the grade of the richest beds even if they were less than 10 feet thick.

Samples were taken at the discovery points indicated on Tom Walker's map, submitted with the original patent application, except that if better exposures were available in nearby cuts from the same stratigraphic horizon or tongue, samples were taken in the most accessible place which, in

the judgment of the mineral examiners, would likely yield comparable results. We believe the results obtained are likely to be comparable to the best material on the claims.

It should be specifically understood that by taking these samples, we do not admit that the locators or claimants actually found these points prior to February 25, 1920, or that they actually used these points as their discovery points.

We believe our approach represents the best sampling done thus far on the claims, and with the previous information, including some drill hole information, provides a good basis for evaluating the mineral values of the claims.

Three meetings were held with Carter Oil Company (EXXON, Inc.) representatives to obtain as much information as possible about the claims, including the location of discovery points, whether the locators found or relied upon such points on the date of location or the date of the passage of the Mineral Leasing Act on February 25, 1920. They were unable to provide much new information and indicated they were relying on the work of Tom Walker, the surveyor who prepared the map that accompanied the patent application. They did provide some corehole information and authorized the USGS to furnish us some proprietary information. These meetings were on May 11, June 1, and June 17, 1976. After we offered them the opportunity, they chose not to accompany us on our field examinations.

Searches and reviews were made of the files in the Colorado State Office Records Section, the Federal Records Center at the Denver Federal Center, and the District Court files.

We reviewed the newspaper files in Rifle, Meeker, and Glenwood Springs for the period March-June 1918 to determine weather conditions and other information of possible interest.

Old newspaper files and the Historical Records of the State of Colorado were examined looking for information about oil shale activities and weather conditions at the time of location. The Grand Valley News of these dates had been destroyed by fire. The files of the Rifle Telegram-Reveille, the Meeker Herald, the White River Review, and Glenwood Post were examined, but little useable information was found. The records of the State Historical Office were very good. Their collection had been put together by a D&RG traffic employee who was interested in oil shale development and had made an extensive file of clippings and other information of the day. (This file had been examined and reviewed by the State Office in connection with Colorado Contests 359-360.)

Old-time residents of the Piceance Creek Basin were located and interviewed about weather conditions and activities in the area.

Ray Filner of Rifle, Colorado, who entered the county about 1913, worked and lived there until his recent retirement except for a period of military service during 1917-1919. He had a homestead just north of the claimed area along Willow Creek, and he said he did not see any of the location notices or work on the claims until in the early and middle 1920s.

H. Gaylord Howe, Denver, Colorado, whose father homesteaded part of Section 33, said he was ten years old at the time, but does not remember any work or stakes on the claims until in the 1920s.

W. Donald Howe, brother of H. Gaylord Howe, of Brush, Colorado, was 20 years old when his father homesteaded on Section 33, and later homesteaded in the same area in his own right. He had, in the 1920s, given an affidavit about their homesteads and the mining claims in the locality, confirming what his father, Henry Adams Howe, had said. He said after his father had located the homestead, they heard about mining claims in the locality and made a search for the location notices and markers. They did not find any within two miles of their homestead in Section 33. His father was an engineer and would probably have recognized markers if present. He said the work on the claims was done during the 1920s and markers erected then.

Lawrence Regel, (age 75-80) now retired and residing in Meeker, had lived in the area most of his life. He said all stock was brought down to lower elevations during the winter. The only way you could get around in the high country during the winter was by snowmobile and snow shoes and they didn't have snowmobiles during the 1920s and before. He didn't know of any work being done nor believed any had been done during the winter at the time of location.

Present day ranchers in the area were interviewed. Although not as old as the other people, they were familiar with events involving the mining claim work. They agreed most of the work was after February 25, 1920.

Reuben Oldland (born 1919 +- 1) has lived in the Piceance Creek area all his life. He has owned and controlled most of the patented land in Stewart Gulch and over the ridge into the West Fork of Parachute Creek. He says that travel along the ridge was nearly impossible during the winter months because of snow. He remembers that during the summers some of the work was done on the claims during the late 1920s. He believes that was when most of the early work was done. He had reported in an earlier interview that the bulldozer cuts were made during the mid 1950s.

Pat Johnson (about 58 +- 1) was born and reared in the area, and has property at the head of Willow Creek, as well as on Piceance Creek. He said it would be a very mild winter to be able to travel in the high country during the winter. It is usually into May before it is open to travel. He said the fences were covered with snow at his upper place on April 1, 1976. He considered it an average winter.

VI. Geology and Mineralization

A. General Geology

The claims are in the Piceance Creek Basin, an intermountain basin located in northwestern Colorado. It is the northeastern corner of the Colorado Plateau Geologic Province and the Rocky Mountain Province is adjacent on the north and east. The basin is marked on the east by the White River uplift and the Sawatch Range, on the north by the extension of the Uinta uplift, on the west by the Douglas Creek arch, and on the south by the Uncompaghre uplift.

In the area of the claims the regional dip is 1-2 degrees to the north as mapped on the Mahogany marker. The Mahogany marker is 490 to 900 feet below the surface of the claims depending upon the topography.

From oldest to youngest, the formations of importance in the area of this report are:

1. The oldest formation of importance in the report area belongs to the Cretaceous Mesaverde group and consists mainly of sandstones and shales. This group produces oil and gas, but only in limited quantities in the basin area. It is not fully explored. It also contains the coal beds that outcrop along the eastern edge of the basin. These coal beds lie at great depths under the oil shale lands. It contains several beds resistant to erosion that form the ridges and hogbacks along the eastern edge of the basin. (Grand Hogback north of Rifle).

2. The Ohio Creek formation containing some natural gas overlies the Mesaverde.

3. The next formation in the sequence is the Wasatch formation consisting mostly of clays, shales, and some sandstones. It is highly colored and readily noticeable along all edges of the basin. It has a low resistance to weathering and forms many rounded hills and slopes. The upper part is the source of some of the gas in the Piceance Creek gas field.

4. The Tertiary Green River formation conformably overlies and intertongues with the Wasatch formation and outcrops along all edges of the basin. Its various members consist of beds of oil shale, marlstone, shale, siltstone, sandstone, tuffs, and oolitic, algal, and ostracodal limestones. The Green River formation, particularly the rich oil shale beds, is very resistant to weathering and forms many cliffs, ledges, and steep slopes. It is subdivided into four members -- the Douglas Creek, the Garden Gulch, the Anvil Points, and the Parachute Creek.

The lowest members are the Douglas Creek and the Garden Gulch. Although exposed along the edges of the basin, they are not exposed in the area of the claims. The Anvil Points member is the lateral equivalent

of the Douglas Creek and Garden Gulch, replacing it in the southeast part of the basin. The Anvil Points is also not exposed in the area of the claims. The Douglas Creek member is the source of most of the gas in the Piceance Creek gas field.

The top of the main body of the Parachute Creek member is exposed about one mile north of the Carbon No. 4 claim in the East Fork of Willow Creek and about one and one-half miles southeast of the Elizabeth No. 1 claim in the West Fork of Parachute Creek, but not on the claims. This member contains the rich oil shale beds. The best known of these oil shale beds is the Mahogany zone (subsurface), known as the Mahogany ledge where it outcrops on the surface. The Mahogany ledge outcrops in West Fork Parachute Creek about three miles southeast of the closest claim (Elizabeth No. 1). Several other rich oil shale beds lie above and below the Mahogany zone in the Parachute Creek member.

In the area of the claims, there are four mapped light-colored marlstone tongues interfingering with the Uinta formation that are assigned to the Green River formation by the U.S. Geological Survey. Geologic mapping shows that these beds merge to the south and east with the main body of the Parachute Creek member. These tongues are the only part of the Green River formation exposed in the area of this report.

5. The principal and uppermost formation exposed on the claims is the Uinta formation, overlying the Green River formation. The Uinta was formerly called the Evacuation Creek member of the Green River formation. It is a reddish-brown sandstone that is several hundred feet thick and weathers from rounded hills to steep-sloped valleys and ridges. The marlstone tongues of the Green River formation intertongue with this formation; they vary in thickness from a few feet to possibly 40 feet with variances from place to place. There are a few light-colored lenses of marlstone that may also belong to the main body of the Parachute Creek member.

B. Specific Geology

1. Surface Geology and Mineralization

The formation outcropping on the surface used to be called the Evacuation Creek (upper) member of the Green River formation (see USGS Bulletin 1082-L, 1961). The Geological Survey changed its nomenclature and now calls the formation outcropping on the claims the Uinta formation (see USGS Bulletin 1394-G, 1974). The Uinta formation replaces the Evacuation Creek member and, in great part, lies directly above the Parachute Creek member of the Green River formation. In addition to changing the name of the formation, they have identified a number of tongues of the Green River formation which interfinger with the Uinta formation (see USGS Bulletins 1394-F, 1974 and 1395-G, 1975). These tongues are postulated to become part of the main body of the Green River formation toward the south end of the Piceance Creek Basin. From highest to lowest, the following tongues have been named:

Marlstone at Bull Fork-----(Tgbf)
Marlstone at Barnes Ridge--(Tgb)
Marlstone at Stewart Gulch-(Tgs)
Coughs Creek Tongue--------(Tgc)
Black Sulphur Tongue
Thirteenmile Creek Tongue
Dry Fork Tongue
Yellow Creek Tongue

Additional tongues may be identified. Also, small local lens of marlstone-like material have been found.

The first four tongues outcrop on the subject claims and are shown on recent geologic mapping of the Cutoff Gulch Quadrangle (MF-691) and Bull Fork Quadrangle (in press). The marlstone at Bull Fork is not shown on MF-691, but it does outcrop in places on portions of the Elizabeth Nos. 1-8 claims on the quad.

On the subject land the tongues outcrop in places, but generally are not well exposed. Therefore, it is difficult to judge their true thicknesses. In many places they represent changes in lithology, erosional surface, and cover (vegetation) which are visible from a distance and traceable on aerial photographs. Probably the best information on these tongues is from the four coreholes on which we have data which were drilled and cored from the surface by the Wasatch Development Company, and assayed by the Bureau of Mines (the Stuart, Tom and Elizabeth Nos. 1 and 2 coreholes). These data indicate that, at the points where the holes were drilled, the Bull Fork marlstone was about 15 feet thick, the Barnes Ridge marlstone was about 13 feet thick, the Stewart Gulch marlstone from 19 to about 26 feet thick, and the Coughs Creek marlstone about 13 to 36 feet thick.

Analysis of the results of assaying samples from these holes, our sampling and previous sampling, indicates that, in the vicinity of these claims, the tongues contain the following amounts of shale oil or kerogen:

Bull Fork marlstone: Generally very low. Surface samples, including both present and past sampling, assayed either a "trace" or "no oil". The Tom corehole showed 15 feet varying from 0.1 to 5.4 gpt, with a weighted average of 0.8 gpt. Kuehnel described a sample one-inch thick, taken by Irving Nielsen, which allegedly assayed 9.2 gpt.

Barnes Ridge marlstone: Generally very low. Surface samples assayed from "no oil" to 1.0 gpt. The Tom corehole showed 13 feet of marlstone assaying from 0 to 1.3 gpt with a weighted average of 0.3 gpt.

Stewart Gulch marlstone: Generally higher in grade than the upper tongues. Surface sampling assayed from "no oil" to 15.8 gpt and appears, in surface sampling, to be higher grade to the west on the Carbon Nos. 1 and 2 claims than to the east on the Elizabeth Nos. 1, 4, and 5 claims. The Stuart drill hole on the Elizabeth No. 11 claim showed 25.7 feet that

ranged from zero to 8.1 gpt with a weighted average of 5.1 gpt. The Elizabeth #2 Corehole (also known as General Petroleum Corporation Corehole 32-36) showed 19.6 feet averaging 6.4 gpt and 43.2 feet averaging 3.7 gpt on the Elizabeth No. 4 claim. Our surface sampling of a mineable thickness (10 feet) showed one claim (Carbon No. 2) with a grade in excess of 8 gpt (8.3 gpt).

Coughs Creek tongue: This tongue is generally higher than the upper two tongues. The assays from surface sampling ranged from 1.4 to 10.6 gpt. The Stuart Corehole showed 1.2 feet that assayed 15.6 gpt average and 30.2 feet with a weighted average of 1.8 gpt. The Elizabeth #2 showed 36 feet that averaged 5.4 gpt.

A comparison of assay results of various investigations is shown in Appendix C.

2. Subsurface Geology and Mineralization

a. Knowledge up to February 25, 1920

(1) Woodruff and Day, in USGS Bulletin 581, 1913, (published in 1915). Measured surface sections nearest the claims are shown as follows:

Location	Shortest Distance From Claims	Descrip. of Mineable Thicknesses of "High Grade" Shale
Sec. 29, T. 5 S., R. 95 W.	9 miles	31' of Est. 20 gpt
Sec. 26, T. 7 S., R. 97 W.	16 miles	81' of Est. 20 gpt
Persistence of beds was not discussed, but the map shows the area of the claims as underlain by bituminous shale.		

(2) Winchester, in USGS Bulletin 641-F, 1916, measured surface sections nearest the claims as shown on Table 2.

b. Knowledge as of the Present

There are numerous drill holes in the vicinity of the claims which penetrate the rich Mahogany zone of the Parachute Creek member of the Green River formation. As shown on USGS Map 746 (1976), "overburden" over the top of the Mahogany zone varies in thickness from less than 400 feet on the Carbon Nos. 3 and 4 claims in East Willow Creek to over 1,200 feet on the Elizabeth Nos. 7-12 claims on the ridges. The average overburden thickness is probably about 1,000 feet. The Mahogany zone in the vicinity of the claims varies in thickness from about 115 to 125 feet. In addition, there are several other rich oil shale zones below the Mahogany zone that underlie the claims.

TABLE 2

Location	Shortest Distance From Claims	Description of Mineable Thicknesses of "High Grade" Shale
Sec. 5, T. 4 S., R. 94 W.	14 miles	11' of less than 15 gpt
"	"	2' of est. 25 gpt
"	"	1' of est. 30 gpt
"	"	2' of "rich" shale
Sec. 20, T. 4 S., R. 94 W.	"	5' of 12.5 gpt
"	"	2' of est. 15 gpt
"	"	11' of less than 10 gpt
"	"	1' of probably rich shale
Sec. 27, T. 4 S., R. 94 W.	13½ miles	4' of 15.5 gpt
"	"	2' of est. 10 gpt
"	"	10' of probably rich shale
"	"	2' of 7 gpt
Sec. 6, T. 6 S., R. 94 W.	17 miles	10' of 40.6 gpt
"	"	4.5' of 28 gpt
Sec. 14, T. 6 S., R. 95 W.	16 miles	100' of cliffs, probably rich
"	"	15' of 11.2 gpt
"	"	13' of 15.4 gpt
"	"	20' similar to above
"	"	35' of "fairly rich" shale
"	"	6' of rich shale
"	"	8' of 20.7 gpt

Winchester states: "the middle part of the formation contains, at every locality examined, beds of shale that will yield considerable oil" (p. 165) and ".....the thin beds of the oil yielding portion are remarkably persistent" (p. 166). However, on page 167, he described changes in individual beds within less than one-half mile. Winchester's map (Plate XVIII) shows the area of the claims underlain by the "Green River formation, contain(ing) beds of oil shale in most places".

Table 2. Measured surface sections from USGS Bulletin 641-F, Dean E. Winchester, 1916.

The subsurface oil shale resources in mineable thicknesses 1/ in the vicinity of the claims vary from over 12 million barrels per 160-acre claim for shale averaging 40 gpt to over 300 million barrels per 160-acre claim for shale averaging 10 gpt. Exact figures cannot be released because Carter Oil Company requested that information on their hole, which penetrates more of the section than other holes in the vicinity, be held confidential. 2/

3. Other Possible Mineralization

a. Locatable Minerals (Mining Law of 1872, as Amended): No minerals that are presently locatable under the mining laws were observed on the claims. The Piceance Creek Basin has no record of such locatable minerals.

b. Saleable Minerals (Materials Act of 1947, as Amended by P.L. 167): No saleable minerals were found on the claims; none are known to be in the locality of the claims.

c. Leasable Minerals (Leasing Act of 1920, As Amended): The known leasable minerals in the Piceance Creek Basin are oil shale, oil and gas, sodium and coal. Presently, the only production of any of the leasable minerals in the Piceance Creek Basin is oil and gas. The main production is from the Piceance gas field 25 miles north of this report area. There are a few other scattered producible wells in the basin, but except for the CONOCO wells in Willow Creek, none are near the area of the claims.

Minor amounts of coal have been produced from around the edges of the basin from the Mesaverde formation, but none in the vicinity of the report area where the Mesaverde formation is several thousand feet deep. Use of this coal is not foreseeable.

Sodium minerals, dawsonite, halite, and nahcolite have been found about 18 miles north of the subject area. Four leases were issued in 1971, but they have not been developed. These minerals were not discovered until the 1960s. Presence of sodium minerals on these claims has not been established nor claimed by the applicant.

1/ Ten feet or more thick.

2/ Personal Communication, Henry Schuh, District Geologist, Carter Oil Company, December 28, 1976.

C. Comparison with Lands in Freeman v. Summers Case

Some of the subject claims (namely, the Elizabeth Nos. 1, 8, and 9) are adjacent to or within one-quarter mile of the lands involved in the Freeman v. Summers case, 52 L.D. 201, 1927, in sections 1-3, T. 5 S., R. 97 W., 6th P.M. The geology on some of the claims is virtually identical to that on the lands in the Freeman v.Summers case. The Coughs Creek tongue and the Stewart Gulch, Barnes Ridge and Bull Fork marlstones outcrop on parts of the lands in Freeman v.Summers. As far as can be determined by visual observation, the kerogen content of the marlstones is similar. The lands in Freeman v. Summers are slightly closer to the nearest escarpment----about three miles up the West Fork Parachute Creek from the outcrop of the Mahogany ledge (compared to 3½ airline miles to the closest point on the subject claims, the southeast corner of Elizabeth No. 1).

VII. Mineral Development Work and Surface Improvements

A. Old Work

The old work done in the 1920s was apparently done as assessment work and consists of pits or cuts dug in hillsides. In almost every case, the pits or cuts were dug in one of the recently identified marlstone tongues, so they cannot be considered completely worthless. On the other hand, in many cases there are several cuts in close proximity to each other. Except where they were dug at different horizons of the same tongue, the multiple cuts in the same area provide little or no new information beyond that available in the first cut dug. Further, in view of the extremely low grade of the tongues, of itself the material exposed in the cuts cannot be considered a valuable mineral deposit for development. Therefore, the work of these old cuts towards development of any valuable oil shale deposit is questionable, to say the least. The cuts are badly sloughed in and partial revegetation has been established.

The material in the case file on original patent application (Denver 035626 and Field Division file 4267) for the Carbon Nos. 5-8 claims, plus our interviews, lead us to believe that none of the cuts were made prior to February 25, 1920.

B. Work in the 1950s

During the 1950s, prior to filing the patent application, Wasatch Development Company did considerable work. This work consisted mainly of improving roads, building new roads, and drilling coreholes, and was used for meeting the $500 worth of improvements per claim required for patent.

The improved roads do make access easier to portions of the claims and, from that standpoint, can be considered as aiding possible future developmental drilling. However, the roads cannot be considered as sufficient for any actual mining development.

Some of the drill holes are perhaps even more questionable. Only three of the holes (Carbon No. 1, Elizabeth Nos. 1 and 2 Coreholes) actually penetrated the Mahogany zone, presumably the horizon most likely of development. The rest of the holes were shallow and appeared to be mainly for the purpose of assisting in locating the marlstone tongues from which a "discovery" might be claimed (by projection to the nearby surface). The holes are of value in a negative way--proving the lack of value of the tongues involved.

The applicants also, in most cases, dug dozer cuts in the vicinity of the "discovery" points. These varied from sidehill cuts to cuts up and down slope. These cuts are weathered and sloughed in at present.

C. Recent Work

No recent work was observed. Apparently none has been done since about 1959.

D. Surface Improvements

Other than fences, a few minor stock ponds and some old cabins, no surface improvements were noted except the roads.

E. Improvements and "Discoveries" on the Claims

1. General

Up to eight cuts or pits, in most cases six or less, were dug on each of the claims during the period 1921 to 1926---possibly representing six years of assessment work. Tom Walker's map shows most of them, but in some cases, more were found either by us or by Mackel in 1928. Other than two or three that were in flatter-lying areas, they were all very similar. They were originally about six to eight feet deep or cut into the hill and about six to ten feet high. An appearance of greater depth is given by the dumping of the spoils at the toe. The cuts have slumped or caved the material above the cut, giving the appearance of depths up to 12 to 14 feet; length varies from 12 to 20 feet. Most were dug on the exposure of one of the tongues, but vary as to position in the tongue from near the top with Uinta sandstone exposed in most of the back, to low in the tongue section with Uinta sandstone again showing most of the back, to below the tongue.

About half of the claims had bulldozer cuts made at or near the discovery points as indicated by Walker. Some were up and down the slope,

some angled and others were across the slope. Material cut varied from two feet deep on the cuts up and down hill to four feet deep at the backs of the cross-slope cuts. Many of the samples were taken in cleaned out trenches or cuts in these bulldozer cuts because of the lesser amount of work necessary to get back to fresh, in-place shale.

2. Description of Sampling, Improvements, and "Discovery" by Claim

Carbon #1: The surface of the Carbon No. 1 claim is entirely Uinta with the Tgc, Tgs, and Tgb tongues exposed (See part VI. B. 1. for description of the tongues). The Tgc is exposed only in a small area near the cabin in the bottom of East Willow Creek. It was not a discovery point but a sample was taken because of its dark appearance. The sample was a chip sample across four feet of the section and assayed 10.6 gpt. Five of the early cuts, Walker's Nos. 1-5, and his indicated discovery point are in the Tgs. The sixth cut is in the Tgb. The "discovery" point sample was taken in cut 3 just west of the alleged discovery point. The sample was taken across 4.8 feet of section at the base of the tongue, and assayed 5.5 gpt. The thickness of the tongue here measured 27.2 feet but there may have been more covered at the top. The exposed shale is very light in color and platy. Fresh surfaces are a light to a medium brown.

Carbon #2: The exposed surface of Carbon No. 2 claim is Uinta with the Tgc, Tgs, and Tgb tongues exposed. The Tgc is exposed on both sides of East Willow Creek near the valley floor; the Tgs is exposed on the valley walls; and the Tgb is still higher on the eastern part of the claim. All of the early cuts, Walker's 1-4, and the "discovery" point are in the Tgs near the northwest corner of the claim. The "discovery" point sample, Carbon 2-1, was taken from an exposure in the bottom of the draw, which was surveyed from the corner as indicated on Walker's map. The sample covers 10.1 feet of exposure and assayed 8.3 gpt. A second sample, Carbon 2-2, was taken up the hill in three parts. The top part was one foot and assayed 15.8 gpt; the center section was two feet and assayed 7.0 gpt; and the lower sample was 0.6 feet and assayed 14.8 gpt. The weighted average for 3.6 feet was 10.8 gpt. The total thickness was not determined, but the tongue appears to be split at this point with a sandstone layer between the two sample points.

The early cuts were all very close together and do little, if anything, toward development of the claim. No workings were noticed in the other tongues.

Carbon #3: The exposed surface on the Carbon No. 3 claim is the Uinta formation with the Tgc, Tgs, and Tgb tongues exposed. The Tgc is exposed along both sides of the valley floor of East Willow Creek and the other tongues are exposed at intervals higher on the slopes. The early cuts, Walker's 1 and 3 through 6, are in the Tgs, Walker's #2 is in the Tgb, and the "discovery" point is in the Tgc. The sample at the "discovery" point was taken in three parts---the upper part was taken across 4.4

feet and assayed 6.3 gpt; the center section was 2.9 feet and assayed 3.9 gpt; the lower part was 4.5 feet and assayed 7.7 gpt; these give a weighted average of 11.8 feet at 6.2 gpt. The lower parts were taken about 20 feet south of the upper part. The exposed shale was very light grey and the fresh, broken pieces were a light brown. It weathers in platy or flat pieces. The cuts made during the 1920s were originally about 5-6 feet deep, 6-8 feet high at the back and from 12 to 18 feet long. Slumping and caving has modified the dimensions and vegetation is growing back at the sites.

Carbon #4: The exposed surface material on the Carbon No. 4 claim is the Uinta formation and the Tgc, Tgs, and Tgb tongues. The Tgc tongue is exposed just above the valley floor on both sides of East Willow Creek. The other tongues are exposed at intervals higher up the slopes of the ridges. Three of the early pits, Walker's Nos. 4-6, are along the west slope of the valley and in the Tgc tongue. The "discovery" point was marked as being in this bed and an old lath and stake were found. A sample was taken across 4.8 feet, just above the lower contact with brown sandstone of the Uinta; it assayed 6.5 gpt. The edge of cut 4 was cleared, exposing beds above the sampled section. These beds appeared to be of lower grade than the beds sampled. Photographs are attached showing the "discovery" point before and after sampling. Cuts 1-3 are higher on the hill in the Tgs tongue. The exposed rock has weathered to a very light grey-to-white and has a platy appearance.

The Carbon drill hole is located near the north center boundary of this claim. The Mahogany marker was intersected at 435 feet below the surface. This is the closest the Mahogany marker comes to the surface of any of the claims.

Carbon #5: The exposed surface on the Carbon No. 5 claim is the Uinta formation and the Tgs, Tgb, and Tgbf tongues. The Tgs is exposed just above the valley floor in Bull Fork Draw at the western end of the claim. The other tongues are exposed higher on the ridge east of Bull Fork. The early cuts, Walker's Nos. 1-5, and the "discovery" point are in the lower tongue. The sample taken at the "discovery" point was in four parts----the highest part was 1.0 feet long, assaying 8.0 gpt; part B was 4.7 feet long, assaying 3.4 gpt; part C was 2.7 feet long, assaying 1.9 gpt; and part D, the lowest, was 1.8 feet long, assaying 1.3 gpt. The weighted average was 10.2 feet at 3.1 gpt.

There was a long bulldozer cut near the upper contact. The outcrops were light colored and weathered into platy material, all of which appeared to be low grade.

Elizabeth #1: The exposed surface on the Elizabeth No. 1 claim is the Uinta formation and the Tgb and Tgbf tongues. All the earlier cuts, Walker's Nos. 1-6, are in the Tgb tongue, but the "discovery" point indicated by Walker is in a small lens below the Tgb tongue in a draw.

It was relocated by using the bearing from the section corner. A sample was taken across 1.9 feet of the section and the assay was "No Oil". There were some bulldozer cuts in the eastern part of the claim, possibly in the Tgbf. There is no information to indicate if they were done as assessment work on the claim.

Elizabeth #2: The exposed surface on the Elizabeth No. 2 claim is the Uinta formation and the Tgb and Tgbf tongues. The early cuts, Walker's Nos. 1-5, are all in the Tgb and the "discovery" point is in the Tgbf. The sample was taken at the back of a bulldozer cut in the indicated "discovery" point locality. The sample was taken across 3.6 feet and assayed "No Oil". The rock was a light, marly sandstone lying just above a brown sandstone bed of the Uinta. Apparently the bulldozer work was done to locate a "discovery" point.

Elizabeth #3: The exposed surface on the Elizabeth No. 3 claim is the Uinta formation and the Tgb tongue. Three of the earlier cuts, Walker's Nos. 2-4, are in the Tgb in the western part of the claim. Cut #1 is in the eastern part of the claim in brownish sandstone. The "discovery" point is in the north-center part of the claim in the Tgb tongue. There are two bulldozer cuts, one up and down the hill and one across the slope. A sample was taken in a bulldozer cut across 6.3 feet and assayed "No Oil". At the south end of the bulldozer cut across the slope were two old pits, not shown on Walker's map, which exposed rock not significantly different from that in the dozer cut.

Elizabeth #4: The exposed surface on the Elizabeth No. 4 claim is the Uinta formation and the Tgs and Tgb tongues. Two of the early cuts, Walker's #1 and #2, are near the southwestern corner and are dug into the reddish-brown sandstone of the Uinta; they contained no visible oil shale or marlstone. They are below the Tgb tongue. The "discovery" point and the other four cuts, Walker's Nos. 3-6, are in the Tgs tongue. The "discovery" point was 57 feet from the section corner, poorly exposed and not near any workings. It is doubtful it could have been noticed at the time of location. The sample from there was taken across 4.8 feet and assayed 2.2 gpt. Cuts Nos. 3-6 are across the valley floor from the "discovery" point, nearly sluffed in and are revegetated.

The Elizabeth Corehole No. 1 is in this same locality. It was drilled to a depth of 858 feet and intersected the Mahogany marker at 724 feet. The core hole cuts a marlstone tongue (Tgc?) beginning at 198.3 feet. Results of assays from the Bureau of Mines at Laramie, Wyoming, are:

SECTION	LENGTH	ASSAY (gpt)
198.3 - 206.6	8.3'	3.8
206.6 - 211	4.4'	8.9
211.0 - 217	8.0'	6.4
219.0 - 225	6.0'	6.5
225.0 - 234	9.0	6.0

Although one section exceeded the 8.0 gpt cutoff point, it is too thin to be commercial. The weighted average of 36 feet was 5.4 gpt.

Elizabeth #5: The exposed surface on the Elizabeth No. 5 claim is the Uinta formation and the Tgs and Tgb tongues. The Tgs is only exposed in a branch of West Fork Stewart Gulch at the western end of the claim; the Tgb is higher on the ridges. Cut #1 is in the Tgb near the north center part of the claim. Cut #6 is below the Tgb in the brown sandstone of the Uinta. Cuts Nos. 2-5 and the "discovery" point are in the Tgs. An old lath and surveyor's stake were found near the alleged discovery point. The sample was taken about 75 feet west of the lath along the bedding at a better outcrop. The sample length was 2.4 feet which assayed 1.8 gpt. The rock weathered out in layers, light-grey-to-white on the surface, but is a light brown on newly-broken faces. There was a bulldozer cut at the toe of cuts Nos. 2-5.

Elizabeth #6: The exposed surface on the Elizabeth No. 6 claim is the Uinta formation and the Barnes Ridge (Tgb) tongue. The earlier cuts, Walker's Nos. 1-5, and the two "discovery" points are all in this tongue. The exposed rocks are very light grey with some breaking into small tabular pieces. The fresh-broken surfaces are a very light brown. One sample was taken about 78 feet northwest of an old stake that may have been a discovery marker. This location was in a bulldozer cut that had a better exposure. This sample, Elizabeth 6-1-1, was taken across 5.7 feet of section and assayed a trace of oil. Just below the sample was a foot of weathered mudstone that was lying on the brown sandstone of the Uinta. A second sample, Elizabeth 6-1-2, was taken in Cut #4 near the second alleged discovery point. It was 6.4 feet in length and assayed "No Oil". Corehole 6A was drilled about 100 feet above the alleged discovery point and Cuts Nos. 2-4.

Elizabeth #7: The exposed surface of the Elizabeth No. 7 claim is the Uinta formation and the Tgb and Tgbf tongues. Of the earlier cuts, Walker's #6 and the western "discovery" point are in the Tgbf and the others, Walker's Nos. 1-5, and the second "discovery" point are in the Tgb. The first sample taken, Elizabeth 7-1, was taken across 8.8 feet and assayed "No Oil". It was taken in a bulldozer cut near the indicated western "discovery" point. The second sample, Elizabeth 7-1-2D, was 5.6 feet long and assayed "No Oil". It was from an outcrop at the alleged second discovery point near the north edge of the claim.

The Tom corehole was drilled on this claim to a depth of 570 feet, but did not intersect the Mahogany marker. Also, Corehole 7A was drilled on this claim. Tom Corehole is collared above all the tongues. It intersects the Tgbf at 94.8 feet and passes through a 15.2-foot section that assays 0.75 gpt. At 226 feet it crosses through 13 feet that averages 0.3 gpt---this is from the Tgb. The hole bottoms out at 507 feet without penetrating any other bed containing kerogen.

Elizabeth #8: The exposed surface of the Elizabeth No. 8 claim is the Uinta formation and the Tgb and Tgbf tongues. Of the earlier pits, Walker's Nos. 1-3 and 5, and the alledged discovery point, are in the Tgb. The "discovery" point plotted out on a nose of a hill where there was a dozer cut up and down hill for 60 feet long and about two feet deep. An old stake was found on the edge of the cut and a sample was taken at this point. It was 6.4 feet across the section. The lower edge of the sample was the contact of the brown sandstone of the Uinta. The sample assayed No Oil.

Elizabeth #9: The exposed surface on the Elizabeth No. 9 claim is the Uinta formation and the Tgb and Tgbf tongues. The Tgb is only limitedly exposed at the north-center edge of the claim. No workings were found in it. The workings and "discovery" point are in the Tgbf. The "discovery" point was resurveyed by tape and Brunton and found to be in a small water reservoir for livestock. A sample was taken from the edge of the reservoir. It was taken across 3.6 feet and assayed a trace of oil. No lath or stake was found. From appearances, the pond was built since the work of 1957, so probably the stakes were destroyed.

Elizabeth #10: The exposed surface of the Elizabeth No. 10 claim is the Uinta formation and the Tgb and Tgbf tongues. All the old cuts, Walker's Nos. 1-6, and the "discovery" point are located in or adjacent to the Tgb. The sample was taken across 3.6 feet in a bulldozer cut just below where an old lath and stake were found. The rock is light colored, more of a sandy shale than a marlstone. The assay results were 0.1 gpt.

Elizabeth #11: The exposed surface of the Elizabeth No. 11 claim is the Uinta formation and the Tgs, Tgb, and Tgbf tongues. All cuts and both "discovery" points are in the Tgb. Sample Elizabeth 11-1-1 was taken at the indicated "discovery" point in the western part of the claim. It was taken across 6.2 feet and assayed a trace of oil. It was taken 20 feet west of the lath found there and was in a bulldozer cut. "Discovery" point #2 was near the south-center part of the claim and also in a bulldozer cut between cuts Nos. 4 and 5. The sample, Elizabeth 11-1-2, was taken across 2.4 feet and assayed No Oil. The tongue was very light colored, weathers into platy to chucky pieces and appears more like a sandy shale than a true marlstone. Cut #5 was below the tongue in a brown sandstone.

Plotting the location on the geologic map, the Stuart Corehole is collared near the Tgs outcrops. However, it intersects a low-grade section of oil shale from 76.8 feet to 102.5 feet deep. The assays run from a trace to 8.1 gpt, with most of the section from 4.0 to 7.7 gpt. The weighted average of 25.7 feet was 5.1 gpt. A second section from 222.2 to 238.5 feet deep is tentatively assigned to the Tgc tongue. A 1.2 foot section assays 15.8 gpt and the rest ranges from 0.2 to 3.8 gpt. The weighted average over 30.2 feet was 1.8 gpt. The hole was drilled in the northeast corner of the claim to a depth of 252 feet. It did not encounter the Mahogany marker.

Elizabeth #12: The exposed surface of the Elizabeth No. 12 claim is the Uinta formation and the Tgs, Tgb, and Tgbf tongues. The Tgs is exposed along the valley flanks of the West Fork Stewart Gulch with the other tongues exposed at higher elevations on the ridges to the west. The earlier cuts, Walker's Nos. 1-5, and the alleged discovery point are all in the Tgs on the west side of West Fork Stewart Gulch. A bulldozer cut runs across several of the cuts for about 90 feet. A sample was taken in the dozer cut near the indicated "discovery" point. The sample was in two parts. Elizabeth 12-1A was taken across 4.5 feet of section and assayed 5.1 gpt; Elizabeth 12-1B was 4.0 feet long and assayed 2.4 gpt. The weighted average of 8.5 feet was 3.8 gpt. Walker's Cut #6 is in the Tgb near the western end of the claim.

VIII. Mineral Development Potential and Economics

A. Prior to 1920

One of the best publications on oil shale technology and economics prior to 1920 is a U.S. Bureau of Mines publication entitled "Notes on the Oil Shale Industry with Particular Reference to the Rocky Mountain District" by M. J. Gavin, H. H. Hill and W. E. Perdew, dated May 1, 1919. This publication was later greatly expanded and published as Bulletin 210, 1924.

Conditions in the United States in May 1919 were described as follows:

> "At present (May 1919), there are no shale-oil operations in this country that have reached commercial production, although there is a great deal of activity, particularly in the States of Colorado, Utah, Montana, Nevada, and California, where there are large and easily accessible deposits of rich shale and some shale oil has been and is being produced. Other parts of the country also contain large deposits of bituminous shale, a number of which have been described in the publications of the U.S. Geological Survey. Several small plants are completed or under construction near DeBeque, Colorado, and one plant is under construction near Watson, Utah, besides two small plants near Elko, Nevada, one near Dillon, Montana, and one in California. In addition, several experimental and demonstration plants have been erected in the large cities contiguous to the shale fields. To date none of these plants has operated under conditions that could be considered commercial, nor have they produced more than small quantities of oil during intermittent or short runs." (p. 2)

The status of an oil shale "industry" in 1919 was summarized in the following paragraph:

> "Our oil shales thus constitute a tremendous potential reserve. While oil can readily be obtained from these shales, it has

> not been demonstrated in actual commercial practice whether it can be produced with profit under the conditions obtaining in the United States today. A distinction must be made between the possibilities of local commercial developments under most favorable local conditions and the development of the industry on a sufficiently large scale to supplant in large part the petroleum industry. The latter is obviously many years ahead and must necessarily be the outgrowth of local industries started under rather exceptionally favorable conditions. The question at the time is when and where such local industries can be started. There are to be considered, therefore, the broad questions of technique of mining and retorting shales and the refining of shale oils, as well as the economic considerations of costs and marketing of products. Much remains to be done in the technique of the industry, as it has not been established that the Scotch practice can be adopted in toto or that it is the best for American conditions. Still more remains to be done in establishing reliable cost data and value of products and possible by-products." (p. 4)

An expansion of the above paragraph is found in Appendix D, which is a copy of pages 7-14 of the report.

The discussion of mining and retorting costs and economics in Meschter's report on these claims also contains references to pertinent articles in the 1920 period. Catlin's Elko, Nevada, operations in 1916-1924 probably came closest to "commercial operations". It proved that oil shale couldn't compete with petroleum at the time. See pp. A-324 to A-372, U.S. v. Winegar, Appendix to Contestants Brief. See also the reports and other material prepared for Colorado Contests 359-360.

B. 1930s

In the contestees' attorneys' brief in Contest 11695, received in the Denver Land Office on August 25, 1933, the attorneys made the following statements about conditions in 1933:

> "Now, however, conditions are entirely changed. The overproduction of petroleum from wells during the last few years has taken away interest in oil shale. The prospectors are gone from the hills. The mining engineers are no longer available in the field. The monuments at claim corners have rotted away or been broken down by cattle. It is both difficult and expensive to now do any prospecting on a claim located where Carbon No. 6 is located. Moreover, with the present lack of interest in oil shale as a source of motor fuel it is very difficult to raise the funds at this time for any extensive examination........

> "Fifteen years have gone by since this claim was located. During that period the changes in the conditions surrounding the oil industry have been so marked that oil shale is no longer a prize eagerly sought for. There is no market for oil shale lands today, which would justify the contestees in going to the great expense of sending a full surveyinng party into the inaccessible mountains where this claim is located for the purpose of accurately running the South line of the claim in order to determine whether the stratum from which sample No. 2 was taken outcrops to the North or to the South boundary of the claim."

See also the summary of conditons in the 1930s in the Appendices of Briefs in Colorado Contests 359-360.

C. Present

At the present time, it does not appear that any deposit of oil shale can be considered economic for immediate commercial development. This conclusion is based on the following:

1. Virtually all oil shale projects (including those based on 30 gpt or more shale) are suspended. The suspension of leases on Colorado Tracts C-a and C-b was approved on August 20, 1976. The lessees cited uncertainties on environmental requirements and other things which made the economics of their operations uncertain. However, in connection with Sohio Petroleum Corporation's (lessee for Utah Tract U-b) application for suspension, Sohio, Phillips Petroleum and Sunoco Energy Development Company (together known as the White River Shale Project) filed a position paper on oil shale development in which they cited economics as the main factor. They mentioned that:

----Capital costs had gone from $600 million to $1½ billion for a 100,000 barrels per day (bpd) plant.

----The required price of shale oil, to yield a 15% return on investment, exceeds $20.00 per barrel.

----The present state of retort technology is not adequate to proceed directly into commercial development.

----High risk in all elements of operation---mining, retorting, and upgrading.

----Uncertainty and risk due to environmental and political issues.

They recommended the following program:

----Demonstration modules be built with Government support.

----Subsequent commercialization may require Government support.

----Government assistance to impacted communities needed.

On November 2, 1976, Shell Oil Company announced they were dropping out of Lease C-b. According to news reports, A. T. Ireson, lease manager, said economics is "certainly the overriding" problem and "the high front end costs require a very substantial investment". "The present value in crude oil is just not enough to justify continuing." (Rocky Mountain News, November 3, 1976).

2. Numerous articles stating that commercial shale oil would require more than present price of world oil (about $14/bbl) to be considered economically viable, e.g.:

a. In "Oil Shale Economics: Big Dollars, Big Debt" in Shale Country, May 1976, it is estimated that it would take $21.70/bbl for a 15% DCF rate of return for the Colony Operation.

b. "Commercial Development of Oil Shale: Forecast goes from Cloudy to Bleak", Henry Pforzheimer, Paraho Project, in E&MJ August 1976---states Federal incentives are necessary.

3. The statement made by John Hutchins of Cameron Engineers at their April 1976 briefing that Government subsidies are required.

4. The statements made by industry supporting the Federal subsidy bill now pending in Congress. The companies involved with two processes which supposedly are economic both give reasons why they aren't in commercial development:

a. OXY----combination mining and in-situ. Wants a better area in the center of the Piceance Creek Basin. However, see the article in September 1976 issue, Engineering and Mining Journal (p. 101). The December 1, 1976 Denver Post contained article describing OXY's efforts to join Ashland Oil Company in lease Tract C-b. The article quoted an Ashland official as predicting shale oil could be produced using OXY's process for $11.00 or $12.00 a barrel (less than Middle East oil).

b. Superior Oil Company----requires a blocked area, based on their exchange proposal.

Since discovery points of the subject claims contain material assaying 8 gpt or, in most cases, considerably less than 8 gpt, the tongues which outcrop on the claims obviously have no potential for development in themselves. Even utilizing the rich underlying shale, given the present economics, including environmental costs, a commercial venture would not be profitable. Unless part of a larger operation, these lands would require mining from a shaft and surface disposal of spent shale on top of the Roan Plateau (as opposed to dumping in a canyon), both of which would increase costs.

We believe that it is reasonable to infer similar findings as of February 20, 1920, and at all points in between. The period of 1974-75 probably came closest to approaching viable economics based on theroetical operations.

IX. Factual Conclusions

Based on our investigation and analysis, it is concluded as follows:

A. The lands were open to location on the dates of location.

B. It is possible that the claims could have been located on the ground on the dates indicated in the location certificates. Weather conditions apparently would not have precluded such location.

C. There is evidence the claims might not have been physically located on the ground prior to February 25, 1920, but it is probably not conclusive as to all the claims. However, the evidence is sufficient to warrant using the charge.

D. Other than C. above, there is no evidence of fraud or dummy locators in the location of the claims.

E. There is no evidence that the claimants were in diligent prosecution of work leading to a discovery of valuable oil shale on February 25, 1920, and continued in diligent prosecution to discovery.

F. There is no evidence that the locators or claimants actually found or relied upon the so-called "discovery" points shown in the patent application prior to February 25, 1920.

G. The "discovery" points do not disclose deposits which, in themselves, constitute a valuable mineral deposit of oil shale as of February 25, 1920, as of the present, or as of any time in between.

H. The rich oil shale which underlies these claims was not physically discovered by the claimants until the three holes were drilled in the 1950s.

I. Even assuming that the claimants made a discovery in the rich underlying oil shale prior to February 25, 1920 (which they did not), or that a discovery in lean surface marlstone was connected with or could be followed to the rich underlying shale (which it is not or can not be), the rich oil shale because of unproven technology and unfavorable economics was not a valuable mineral deposit in 1920, at present or at any time in between.

J. In the Union Oil case, 71 I.D. 169 (1964), the Department said the old contests were effective against the claims.

K. Assessment work was not performed from 1926 to 1957. Affidavits of performance of assessment work were filed for the years 1919 through 1925.

L. The following evidence supports the belief that the claims were abandoned from about 1930 to about 1957:

1. Nonperformance of assessment work from 1927 to 1957 and no indication of any work on the ground during that period. The claimants did not even file notices in lieu of annual assessment work allowed during the 1930s and 1940s.

2. Failure to ask for overturning of the Departmental decision of 1930 after Ickes v. Virginia - Colorado Development Corp. decision.

3. The Carbon No. 5 claim was sold for unpaid taxes in 1927 and a Treasurer's Deed issued in 1940.

4. Oil and gas leases were issued for part of the lands with no objection. Also, no amended locations were filed under provisions of P.L. 250 or 585 in 1953 or 1954.

5. Even though H. Comer Wolf died in 1951, his interest in the claims was not probated until after Wasatch Development Company acquired the claims in 1957.

6. Even though oil shale land was selling for several hundred dollars per acre in 1957 (See Contest 359-360), Mrs. H. Comer Wolf sold her interest for $0.39/acre or less.

7. Except for Joseph Umpleby, no claimants came forth in the forfeiture proceedings of 1957.

X. Analysis of Factual Conclusions as Meeting Requirements of the Mining Law

Based upon a comparison of the factual conclusions with the requirements of the mining law, it is concluded that the claims do not meet those requirements in the following aspects:

A. They were not physically located on the ground prior to February 25, 1920, as required by Federal and State law.

B. The locators or claimants were not in diligent prosecution of a discovery on February 25, 1920.

C. The locators/claimants did not, prior to February 25, 1920, rely on the so-called "discovery" points shown in the patent application; therefore, these "discovery" points have no meaning or value.

D. Even if the locators or claimants had relied upon such "discovery" points, such points did not reveal deposits of oil shale which, in themselves, constitute valuable mineral deposits capable of being economically developed.

E. Even assuming, for whatever reasons, the rich underlying shale was available for use for discovery purposes (which we do not agree was the case), the rich oil shale would not constitute a valuable mineral deposit in 1920, at present, or at any time in between.

F. In our opinion, a prudent person would not now or in the past, expend his labor and means in an effort to develop a paying mine on these claims.

G. According to Union Oil Co. of California, et al., 71 I.D. 169 (1964), the old contests against the claims for failure to do assessment work were effective in declaring the claims null and void.

H. The evidence supports our belief that there was not substantial compliance with the assessment work requirements of the Mining Law.

I. The evidence supports our belief that the claims were abandoned from about 1930 to about 1957 in contravention of the Mining Law.

XI. Recommendations

Based upon the foregoing investigation, evaluations, conclusions, and analysis, it is recommended that a contest be brought against all the claims (naming both the Elizabeth and the Elizabeth J claims in the complaint) with the following charges (subject to further adjudication and legal review):

A. The claims were not physically located on the ground prior to February 25, 1920, as required by Federal and State law.

B. The locators or claimants were not in diligent prosecution of work leading to a discovery of valuable oil shale on February 25, 1920, and did not continue in any such diligent prosecution of work to discovery.

C. There has been no discovery of a "valuable mineral deposit" on any of the claims (i.e., a prudent person would not expend his labor and means in an effort to develop a valuable mine on these claims).

D. As set forth in Union Oil Company of California, et al., 71 I.D. 169 (1964), the old contests against the claims were effective in cancelling the claims.

E. There was no substantial compliance with the assessment work requirements of the Mining Law.

F. The claims were abandoned from about 1930 to about 1957.

Edwin H. Montgomery
EDWIN H. MONTGOMERY
Mining Engineer

S. John Goldenstein
S. JOHN GOLDENSTEIN
Mining Engineer

APPENDIX A

C-030979

United States Department of the Interior
OFFICE OF THE SOLICITOR
DENVER REGION
P.O. BOX 25007
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

March 3, 1849

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AUG 17 1976

To: State Director, Colorado, BLM

From: Regional Solicitor, Denver

Subject: Questions Regarding Legal Guidelines for Examination of Oil Shale Mining Claims

This is in response to your May 11, 1976 memorandum on the above subject. Your questions, and our response thereto follow.

"1. What would constitute a valuable mineral deposit of oil shale?"

In its decision United States v. Coleman, 390 US 599, 600 (1968) (footnote 1) the Supreme Court pointed out that

> The cornerstone of federal legislation dealing with mineral lands is the Act of May 10, 1872, 17 Stat 91, 30 USC §22, which provides in §1 that citizens may enter and explore the public domain and, if they find "valuable mineral deposits," may obtain title to the land on which such deposits are located by application to the Department of the Interior. The Secretary of the Interior is "charged with seeing . . . that valid claims . . . [are] recognized, invalid ones eliminated, and the rights of the public preserved." Cameron v United States, 252 US 450, 460, 64 L Ed 659, 662, 40 S Ct 410.

The Court, at pages 600 and 603, then proceeded to define "valuable mineral deposits" in the following manner:

> The Secretary of the Interior held that to qualify as "valuable mineral deposits" under 30 USC §22 it must be shown that the mineral can be "extracted, removed and marketed at a profit" - the so-called "marketability test."

* * *

The Secretary's determination that the quartzite deposits did not qualify as valuable mineral deposits because the stone could not be marketed at a profit does no violence to the statute. Indeed, the marketability test is an admirable effort to identify with greater precision and objectivity the factors relevant to a determination that a mineral deposit is "valuable." It is a logical complement to the "prudent-man test" which the Secretary has been using to interpret the mining laws since 1894. Under this "prudent-man test" in order to qualify as "valuable mineral deposits," the discovered deposits must be of such a character that "a person of ordinary prudence would be justified in the further expenditure of his labor and means, with a reasonable prospect of success, in developing a valuable mine . . . ." Castle v Womble, 19 LD 455, 457 (1894). This Court has approved the prudent-man formulation and interpretation on numerous occasions. See, for example, Chrisman v Miller, 197 US 313, 322, 49 L Ed 770, 773, 25 S Ct 468; Cameron v United States 252 US 450, 459, 64 L Ed 659, 662, 40 S Ct 410; Best v Humboldt Placer Mining Co. 371 US 334, 335-336, 9 L Ed 2d 350, 352, 353, 83 S Ct 379. Under the mining laws Congress has made public lands available to people for the purpose of mining valuable mineral deposits and not for other purposes.[4] The obvious intent was to reward and encourage the discovery of minerals that are valuable in an economic sense. Minerals which no prudent man will extract because there is no demand for them at a price higher than the cost of extraction and transportation are hardly economically valuable. Thus, profitability is an important consideration in applying the

prudent-man test, and the *marketability test which the Secretary has used here merely recognized this fact.

The marketability test also has the advantage of throwing light on a claimant's intention, a matter which is inextricably bound together with valuableness. For evidence that a mineral deposit is not of economic value and cannot in all likelihood be operated at a profit may well suggest that a claimant seeks the land for other purposes.

* * *

As we have pointed out above, the prudent-man test and the marketability test are not distinct standards, but are complementary in that the latter is a refinement of the former.

---

[4] 17 Stat 92, 30 USC §29, provides in pertinent part as follows: "A patent for any land claimed and located for valuable deposits may be obtained in the following manner: Any person . . . having claimed and located a piece of land for such purposes . . . may file . . . ." (Emphasis added.)

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Accordingly, a "valuable" deposit of oil shale is one which can, on the basis of present facts, both economic and technological, be extracted, removed and marketed at such a profit that a reasonably prudent man would be justified in expending his labor and means in the development of a mine. See in this regard United States v. Frank W. Winegar, et al., 16 IBLA 112 (1974)

"2. Meaning of mineral in character as it applies to oil shale. Would oil shale mining claims or 10 acres legal subdivisions within the claims upon which the Mahogany ledge and overlying beds have been eroded be considered non-mineral in character? Should the 10 acre non-mineral subdivisions be surveyed and corners set by cadastral surveyors?"

Assuming the erosion of the "Mahogany ledge" and overlying beds of oil shale effectively removed all deposits of oil shale from a mining claim or any 10 acre subdivision thereof, the answer to the first part of this question is yes. We do not, however, believe that the 10 acre non-mineral subdivisions need to be surveyed by cadastral surveyors at this time. We suggest that such surveys be delayed until the legal determination that such subdivisions are non-mineral in character is established by administrative and/or judicial proceedings. Prior to that time less technical means could be employed to identify with reasonable accuracy those claims or parts of claims as to which a charge of non-mineral in character should be raised.

"3. Discovery -

a. As of February 2, 1920

    (1) Physical discovery of a mineable deposit
        (a) To what extent should we assume locators may have found outcrops having shale oil?
    (2) Use Freeman v. Summers criteria?
    (3) Mining & Processing Questions for example, should we only consider room and pillar and perhaps open pit mining?
    (4) Profitability

b. Loss of discovery between February 25, 1920 (e.g. April 15, 1930 [E.O. 5327]) and present

c. As of present time

    (1) Assume use of Mahogany ledge even though not exposed?
    (2) Mining and Processing Questions
    (3) Profitability"

3. a (1) (a) We believe no assumptions should be made. The mining claim patent applicant should be required to point out with precision the exact place on his claim where the mineral deposit he claims is valuable was actually found by him or his predecessor in interest. In our view,

the mining claimant is not entitled to have the mineral examiner assume his predecessors in title were on the claim, much less that they found any given outcrop regardless of its size.

3. a (1) (b) Old workings should be sampled if the patent applicant designates them as discovery points. If the patent applicant refuses to cooperate the samplings of old workings should be done as the best professional judgment of Bureau examiners dictates.

3. a (2) As Freeman v. Summers, 52 LD 201 (1927) was specifically overruled by the IBLA in its decision United States v. Frank Winegar, et al., 16 IBLA 112 (1974), the criteria established by that anomolous decision should not be used. In this regard it should be noted that Freeman v. Summers was issued in 1927. It was not, therefore, a factor that would have been considered by an oil shale claimant~~s~~ in 1920.

3. a (3) We suggest that you consider only those mining methods that were technically feasible as of 1920.

3. a (4) It is our opinion that profitability is an essential factor to consider in determining the validity of a mining claim. A mining claim is not valid unless the development of the minerals found therein will be, or would have been, sufficiently profitable that a prudent man would invest his time and money in the effort.

3. b It is our opinion that loss of discovery between February 25, 1920 and the present time is an issue that should be included in any subsequent administrative proceedings. We believe, however, that this issue should be covered without expending time and money in preparing new economic analysis or feasibility reports for any particular time during the intervening years unless special circumstances in a particular case should suggest otherwise.

3. c (1) and (2) We believe that it should be assumed for the purpose of presenting the government's case that one presently developing an oil shale claim will mine the Mahogany ledge even though it is not exposed on the claim. While we contemplate a ruling in the Government's favor with respect to the physical finding issue, it may be necessary that we be prepared to present out case on all important facets of the overall question. We believe that mining and processing questions should be answered on the basis of present, not assumed, technology. In this regard, the oil shale lessees in the prototype oil shale leasing program have prepared and submitted much valuable information.

3. c (3) See our response to 3. a (4).

"4. Dummy locators - To what extent can circumstantial evidence be used?"

The use of dummy locators is a fraud on the Government. It is a general rule that fraud will not be presumed but must be affirmatively proven, and

the burden of proof lies with the person asserting it. It is not essential that fraud be proven by direct evidence, but the evidence must be more than suspicion or conjecture. See generally 37 C.J.S. Fraud Secs. 94 and 115. Accordingly, circumstantial evidence may be used in an effort to prove that dummy locators were used in the location of a mining claim.

"5. Assessment Work - What would be considered as substantial compliance?"

Both the quantity (amount of money expended) and the quality (nature of the work done) must be considered in determining whether one is in substantial compliance with the assessment work requirement of the mining law. It is our opinion that when a mining claimant fails to perform assessment work for two consecutive years he is not in substantial compliance with the assessment work requirement of the mining law. Where less than two complete years have elapsed or there has been a resumption of work, the case should be referred to this office for review. It is our opinion that work done on a mining claim that is not done for the purpose of developing a claim for mining purposes is not assessment work. See Hickel v. Oil Shale Corporation, 400 U.S. 48, 57 (1970)

"6. Abandonment - What are the types of evidence which could be gathered to prove abandonment?"

It is virtually impossible to list and discuss all of the facts which might be evidence of abandonment. Moreover, circumstances which might prove abandonment are subject to rebuttal.

A mining claim is abandoned when the locator voluntarily leaves his claim without any intention of asserting a right in the future. Any evidence tending to establish this voluntary intent should be gathered. In this connection mere absence from a claim is not an abandonment. Neither is an amended location made to correct an error in the original location notice. Lapse of time, by itself, does not constitute abandonment (although it creates a presumption of invalidity. United States v. Zweifel, 508 F.2d 1150, (10 Cir. 1975)). On the other hand, failure to perform assessment work is evidence of abandonment. A long absence from a claim together with non-use should also be considered. Statements made by the claimant are evidence, as is failure of a co-owner to contribute to the cost of annual assessment work. This list is not intended to be all inclusive. Any an all facts tending to show an intent to abandon and the act of abandonment are relevant.

"7. Bona Fides in location - who is involved?"

"8. Fraud - what would constitue fraud?"

As any mining location which is not "bona fide", not made in good faith, is in a sense a fraudulent location these two questions are considered together. Also the discussion of dummy locators, infra, should be considered as applicable here.

We do not clearly understand the intent of question 7. If it is intended to ask whether the United States can challenge mining claims not bona fide, i.e., not located or held in good faith, the answer is yes.

Any mining claim knowingly and willfully located or held contrary to the laws of the United States is a fraudulent claim.

It would be difficult, if not impossible, to list and discuss all of the evidence that might be relevant to the question of whether a given mining claim was either fraudulently located or is being fraudulently held. 37 C.J.S. Fraud, Sec. 3 sets forth the elements of fraud as follows:

> "Comprehensively stated the elements of actionable fraud consist of: (1) A representation. (2) Its falsity. (3) Its materiality. (4) The speaker's knowledge of its falsity or ignorance of its truth. (5) His intent that it should be acted on by the person and in the manner reasonable contemplated. (6) The hearer's ignorance of its falsity. (7) His reliance on its truth. (8) His right to rely thereon. (9) And his consequent and proximate injury."

The burden of proving fraud rests with the one who asserts it.

"9. Effect of old contest decisions."

It is our opinion that the old contest decisions, to the extent they are not procedurally defective, canceled the mining claims involved therein.

"10. Effect of any withdrawals, e.g. E.O. 5324, PLO 4522, etc."

Section 37 of the Mineral Leasing Act of 1920, as reprinted in 30 U.S.C.A. 193, provides among other things, that deposits of oil shale

> "shall be subject to disposition only in the form and manner provided in this chapter, except as to valid claims existent on February 25, 1920, and thereafter maintained in compliance with the laws under which initiated . . . ."

With respect to effect of Section 37, the Supreme Court, in Hickel v. Oil Shale Corporation, 400 U.S. 48, 54 (1970) states:

> ". . . the Saving Clause of section 37 of the 1920 Act requires that for lands to escape the leasing requirement the claims must be 'maintained in compliance with the laws under initiated.' "

The Court went on to hold that a mining claim is maintained by "substantial compliance with the assessment work requirements of the 1872 Act . . . ." (Id. at page 57) In other words, the only way for lands containing mining claims located for deposits of oil shale "to escape the leasing requirements" is by the claimant substantially performing the assessment work

requirements of the 1872 law. If he does not perform as required, the lands covered by his claims do not "escape" but are captured by the leasing requirements of the 1920 Act. Nothing more is required. There is no need for the United States to take any affirmative action for the purpose of "recapturing those which had not been 'maintained' within the meaning of Section 37 of that Act." (Id) To the contrary, the Court held that

> ". . . section 37 of the 1920 Act makes the United States the beneficiary of all claims invalid for lack of assessment work or otherwise."

Accordingly, if there was a substantial lapse of assessment work, withdrawals such as E.O. 5324 would have no effect on the outcome of the cases. If, however, there has been substantial compliance with the assessment work requirements the withdrawals mentioned, and the withdrawal effected by the 1920 Act are relevant to the times at which the mining claimant must show he had a discovery of a valuable mineral deposit.

Your attention is directed to the comprehensive briefs that were filed by the United States in the Winegar case, supra. These briefs may be referred to for guidance.

If we can be of further assistance in this matter please advise us.

Lowell L. Madsen

Lowell L. Madsen
For the Regional Solicitor

APPENDIX B

C-030979

DISCOVERIES
ON
OIL SHALE PLACER MINING CLAIMS

IRVIN NIELSEN

GEOLOGIST

DISCOVERIES

ON

OIL SHALE PLACER MINING CLAIMS

INTRODUCTION

There are approximately 50,000 acres of unpatented oil shale claims in the Piceance Creek basin of northwestern Colorado.

The claims were located under the mining law of 1872 and amendments. The passage of the Leasing Act in 1920 withdrew oil shale land from further entry under the mining laws. Existing claims were not affected by the Act.

Although not necessary, it is generally considered advisable to patent these claims.

As part of the patenting procedure, the claim owners are required to show proof of discovery. Since most of the original locators are dead, it is now necessary to show that outcrops of oil shale exist on each claim. The fact that discovery is a pre-requisite to location of a claim and that the locations were recorded at that time, is prima-facie evidence that discovery was made.

I have worked intermittently for the last five years on showing proof of discovery on oil shale claims. During that time, I have been thoroughly confused as to what constitutes discovery. The question seems to be a matter of personal opinion of interested parties. The claim owners naturally favor a liberal interpretation of the requirements while the Bureau of Land Management naturally take a critical view.

DISCOVERIES

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OIL SHALE PLACER MINING CLAIMS

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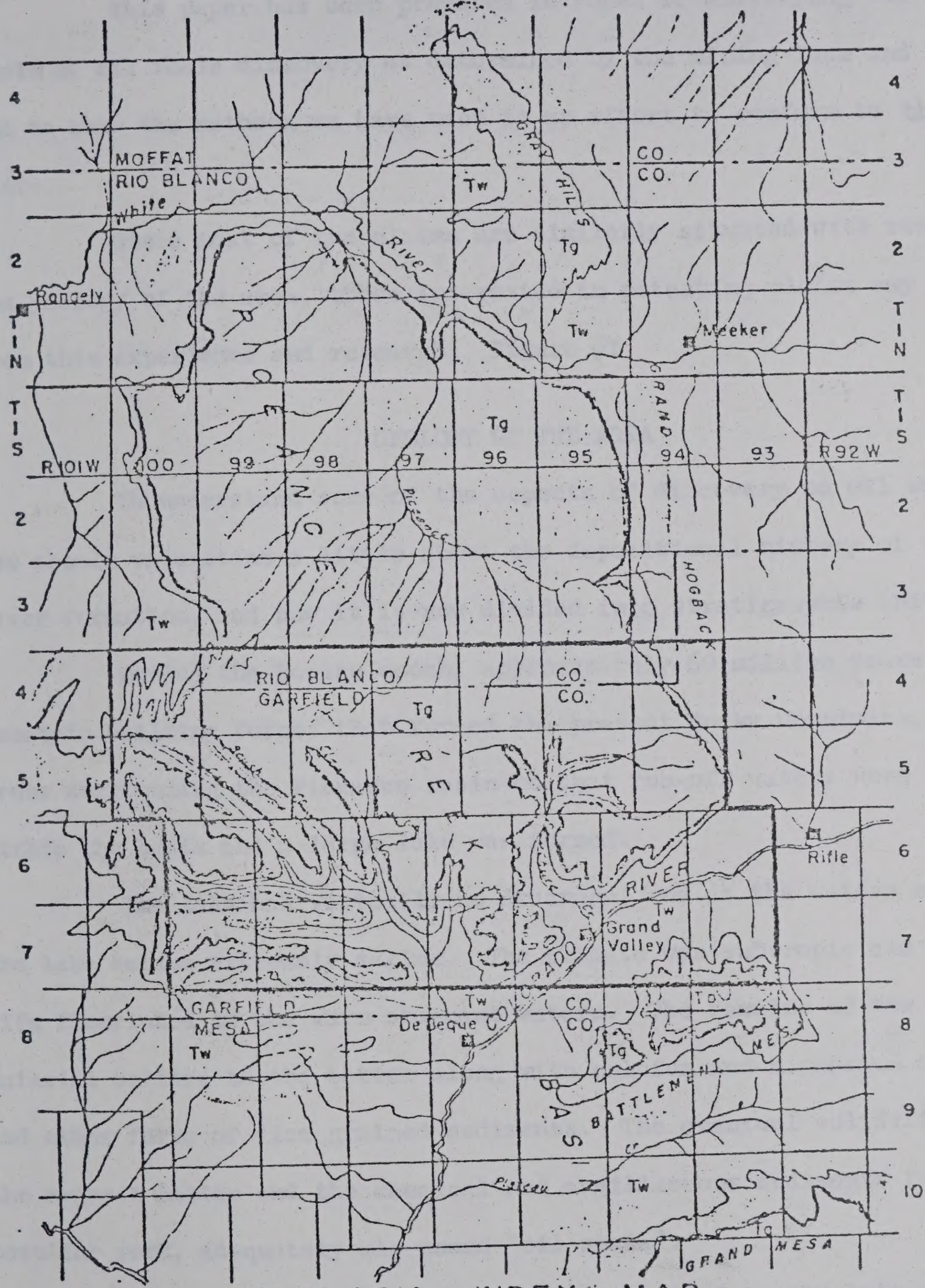
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CO.
White River
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GRAY HILLS
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PICEANCE CREEK
GRAND HOGBACK
RIO BLANCO
GARFIELD
Rifle
COLORADO RIVER
Grand Valley
GARFIELD MESA
De Beque
BATTLEMENT MESA
BASIN
GRAND MESA
Tg

GEOLOGIC INDEX MAP
of the
PICEANCE CREEK BASIN

Eocene

Tg	GREEN RIVER FORMATION
▭	MAHOGANY LEDGE
Tw	WASATCH FORMATION

This paper has been prepared in hopes of clarifying the requirements of oil shale discovery as determined by the mining laws and the courts, and to show the methods we have used in an effort to conform to these requirements.

Since most of the claims are similarly situated with respect to the geology of the area, those interested in patenting claims may profit from this experience and research. Figure #I

GEOLOGY OF THE AREA

To understand some of the aspects of discovery on oil shale claims, one should understand a little about the depositional history of the Green River formation, and how it is now divided into stratigraphic units.

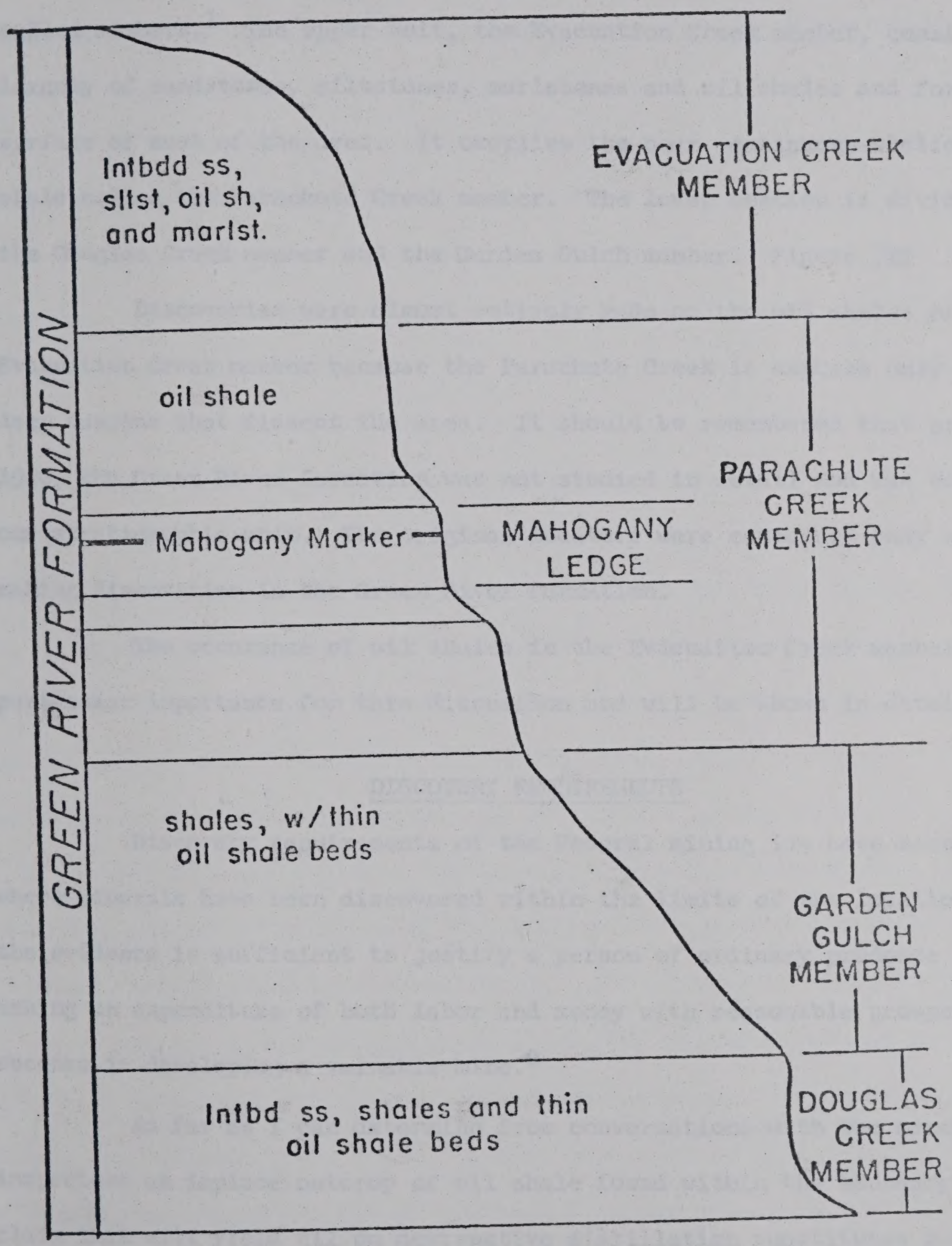
During the Eocene epoch, approximately 60 million years ago, the mountain building forces that formed the present Rocky Mountains, uplifted areas surrounding the Piceance Basin so that run-off waters were trapped within the basin and a large lake was formed.

The lake had virtually no drainage, and as the waters evaporated the lake became extremely saline. The climate was subtropic and microscopic life flourished in the warm stagnant waters. The remains of the organic material settled to the bottom along with calcium and magnesium carbonates and other forms of fine grained sediments. The eventual solidification of the organic matter and the chemical and argillaceous sediments formed the peculiar rock, adequately mis-named "oil shale".

The entire section of sediments deposited in the lake reached and aggregate thickness of about 3000 feet and is known as the Green River formation. Oil shale beds occur throughout the thick deposit.

Figure II

DIAGRAMMATIC SECTION of the GREEN RIVER FM.


GREEN RIVER FORMATION
Intbdd ss, sltst, oil sh, and marlst.
oil shale
Mahogany Marker
shales, w/thin oil shale beds
Intbd ss, shales and thin oil shale beds
EVACUATION CREEK MEMBER
PARACHUTE CREEK MEMBER
MAHOGANY LEDGE
GARDEN GULCH MEMBER
DOUGLAS CREEK MEMBER

In 1931, eleven years after the withdrawal of oil shale claims, under the leasing Act of 1920, Bradley divided the formation into four units called members.[1] The upper unit, the Evacuation Creek member, consists largely of sandstones, siltstones, marlstones and oil shales and forms the surface of most of the area. It overlies the near continuous section of oil shale called the Parachute Creek member. The lower section is divided into the Douglas Creek member and the Gurden Gulch member. Figure #II

Discoveries were almost entirely made on the oil shales of the Evacuation Creek member because the Parachute Creek is exposed only in the deep canyons that dissect the area. It should be remembered that prior to 1920, the Green River formation was not studied in detail and was considered one stratigraphic unit. The original locators were concerned only with making discoveries in the Green River formation.

The occurance of oil shales in the Evacuation Creek member is of particular importance for this discussion and will be shown in detail later.

DISCOVERY REQUIREMENTS

Discovery requirements of the Federal mining law have been met where minerals have been discovered within the limits of the location and the evidence is sufficient to justify a person of ordinary prudence in making an expenditure of both labor and money with reasonable prospect of success in developing a valuable mine.[2]

As far as I can determine from conversations with the mineral inspectors an inplace outcrop of oil shale found within the boundary of a claim that will yield oil on destructive distillation constitutes proof of discovery.

This interpretation conforms to the general rule of discovery. However there seems to be a wide divergence of opinion on the accepted definitions of terms "in-place", "outcrop", "oil-shale" and the importance of quality and quantity of the discovery.

It is necessary to know the definitions of these terms to find suitable proof of discovery in field examinations.

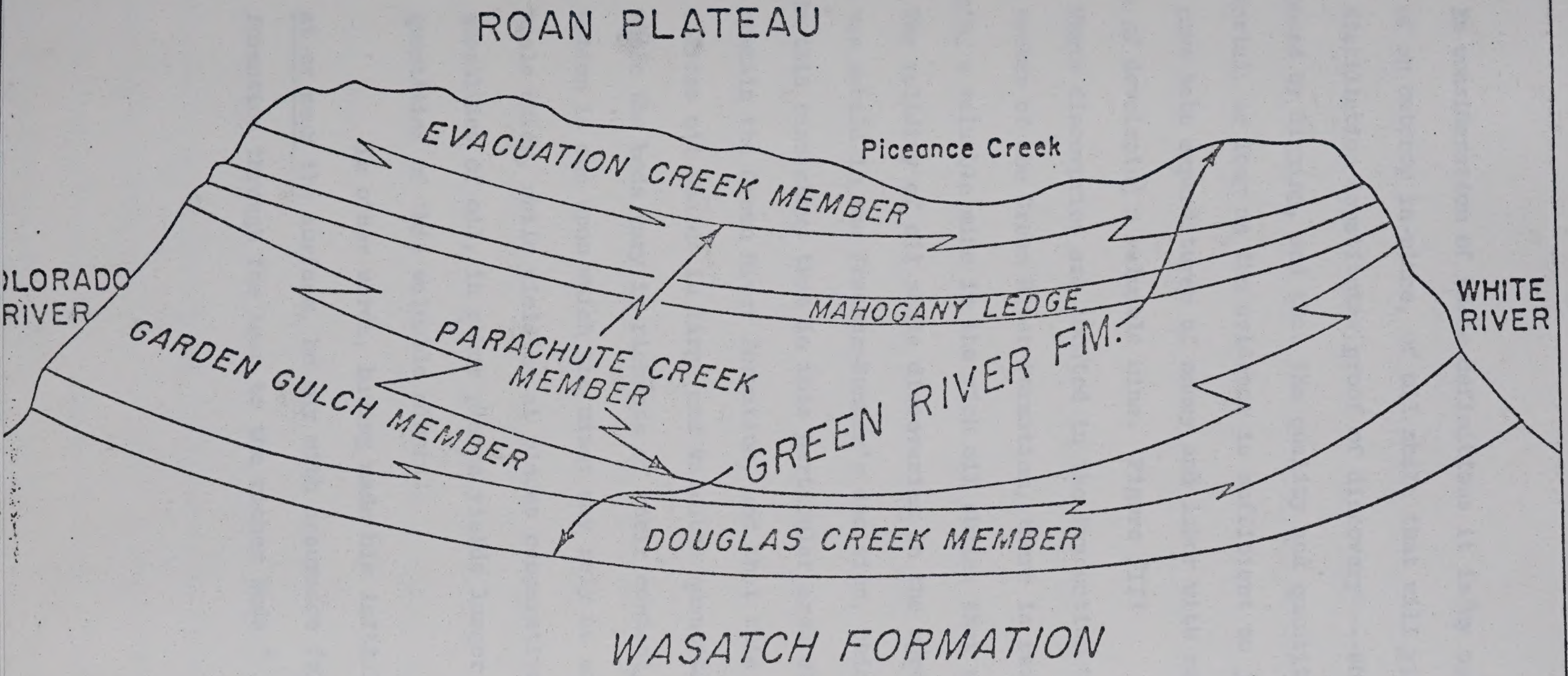
After doing considerable research on mining laws, literature on oil shale and consultations with various law firms, I believe the following definitions are correct.

The term "in-place" means that which is enclosed and embraced in the fixed and unmovable rock forming the general mass of the mountain as distinguished from merely on the surface.[3]

The term outcrop or outcroppings as used in mining law refers to the edges of strata appearing at the surface of the ground or which appear immediately under the soil or surface debris ---- it means that it comes so near to the surface of the earth that it is found easily by digging or is the point at which the vein is nearest the surface of the earth.[4]

The term oil shale as commonly used covers a wide variety of laminated, solidified mixtures of argillaceous sediments and organic matter having the common property of yielding oil upon destructive distillation.[5]

The importance of quality and quantity of the discovery is well defined in many court decisions, and reference books on mining law. For example the following, "No court has ever held that in order to entitle one to locate a mining claim, ore of commercial value, either in quality or quantity must first be discovered. Such a theory would make most mining locations impossible".[6] This interpretation is further substantiated by the Freeman-Summers decision.[7]


ROAN PLATEAU
EVACUATION CREEK MEMBER
Piceance Creek
OLORADO
RIVER
MAHOGANY LEDGE
WHITE
RIVER
PARACHUTE CREEK
MEMBER
GARDEN GULCH MEMBER
GREEN RIVER FM.
DOUGLAS CREEK MEMBER
WASATCH FORMATION

IDEALIZED CROSS SECTION
Thru the
PICEANCE CREEK BASIN

In consideration of these definitions it is my opinion that the existance of an outcrop in-place, of oil shale that will yield oil on destructive distillation constitutes proof of discovery----that the outcrop may be exposed by digging, and that the quality and quantity of the discovery is not material, as long as the evidence is sufficient to justify a prudent person to make both expenditures of money and labor with reasonable prospect of success of developing a valuable mine. Figure #III

Where discoveries are located in the Evacuation Creek member, the uppermost member of the Green River formation, there is reasonable prospect of developing a valuable mine in the rich oil shales that underly the member.

The validity of oil shale discoveries in the upper Green River formation was upheld in the Freeman-Summer's decision, which said that, "The evidence in this case shows that in this particular area of Colorado the lands

> contain the Green River formation, and that this formation carries oil shales in large and valuable quantities; that while the beds vary in richness of their content, the formation is one upon which the miner may rely as carrying oil shale which, while yielding at places comparatively small quantities of oil, in other places yields larger and richer quantities of this valuable mineral.
>
> In other words, having made his initial discovery at or near the surface, he may with assurance follow the formation through the lean to the richer beds."

FIELD METHODS

During the last two years extensive exploratory work has been conducted on unpatented oil shale claims in T4S, Ranges 97 and 98 West.

The purpose of this work was to determine the quality and quantity of oil shales in the Parachute Creek member for reserve estimates and to study the oil shales beds in the Evacuation Creek member that are used as discovery beds.

The results of core drilling in this area are compiled in this Figure #IV.

The continuity of the Parachute Creek member is readily discernible in this illustration. Note the correlative units, the "Mahogany Marker", the "Thick Tuff" and the "Crystal Cavity zone".

I consider the top of the Crystal Cavity zone as the top of the Parachute Creek member. The zone is both traceable in cores and exposures of the section.

Above the Crystal Cavity zone is the Evacuation Creek member. The oil shales are more numerous near the base of the member, but thin oil shale beds were found nearly 1200 feet above the Mahogany Marker. This was the highest section of the Evacuation Creek member present in this area.

As you can see, there are many other oil shale beds scattered throughout the section.

Several of these beds were found in surface exposures and will be used as proof of discovery on the claims. Samples from each of the discovery outcrops were tested qualitatively in the field or by commercial laboratories.

One field method used, was to retort a small amount of crushed oil shale in a test tube with a small butane torch. The method follows that described by Winchester as used prior to 1920.

While this method is sufficient to show that the richer beds will yield oil, it is not an adequate test for the very low grade oil shales. The lithologic examination of the cores shown in Figure IV showed the beds illustrated by solid black areas as being definitely oil shale. The assay of the Elizabeth #2 core by the Bureau of Mines showed that the entire sampled section of the Evacuation Creek (the lower 600') in the core yielded some oil.

This partially substantiates the contention in the Freeman-Summers Case that nearly all beds of the upper Green River formation will yield some oil.

All of the cores drilled in the area shown in Figure IV have not been assayed. When the assay work is complete, we will know considerably more about the Evacuation Creek oil shales.

One aid in finding oil shale outcrops is the use of aerial photographs. We have used photos on a scale of 1" to 1000'. The photos are particularly useful in following discovery beds of oil shale from one claim to another.

CONCLUSIONS

In conclusion, it is my opinion that to show proof of discovery in the Evacuation Creek member on oil shale claims, it is necessary to find oil shale in an in-place outcrop, either at or near the surface, within the boundaries of the claim ---- that the outcrop may be found by digging through the surface debris and the quality and quantity of the discovery is immaterial

I would like to express my appreciation to Mr. John Savage and Wasatch Development Company for releasing the core data presented here, to the law firms of Cole, Mincer and Larson, and Parkinson and Stewart for their assistance in finding the pertinent legal references, and to Tom Walker who supplied much of the core and map data.

This paper has outlined my interpretation for requirements for proof of discovery for patenting purposes. Since a correct interpretation is essential in this type of work, I would appreciate any criticisms or questions. I hope that this paper has helped to clarify the requirements for discovery for those anticipating similar work.

REFERENCES

1. Bradley, W. H. 1931, Origin and Microfossils of the Oil Shale of the Green River formation of Colorado and Utah: U. S. Geology Survey Profession Paper 168, p. 9.

2. Ricketts, American Mining Law, Vol. 1 Bull. 123, Para. 596.
3. Ricketts, American Mining Law, Vol. 1 Bull. 123, Para. 158.
4. Ricketts, American Mining Law, Vol. 1 Bull. 123, Para. 165 and footnotes.
5. Guthrie, U. S. Bureau of Mines Bull. 415, 1938.
6. Lindley on Mines Vol. 2. Para. 336 p. 769
7. Freeman-Summers 52 L. D. 202
8. Freeman-Summers 52 L. D. 206

APPENDIX C

COMPARISON OF ASSAY RESULTS

Name & Number of Claim	Tongue	Kuehnel	McIntosh & Meschter 1/	Montgomery & Goldenstein 2/	Other Samples	Drill Hole Information
Carbon #1	Tgs		4.9 gpt, 20' thickness represented	5.5 gpt; 4.8' thickness	10.6 gpt, 4.0' thickness; Tgc	
Carbon #2	Tgs		8.0 gpt, 10' thickness (chip sample)	8.3 gpt, 10.1' thickness	10.8 gpt, 3.6' thickness	
Carbon #3	Tgc		6.3 gpt, 13' thickness represented	6.2 gpt, 11.8' thickness		
Carbon #4	Tgc		1.4 gpt, 5' thickness represented	6.5 gpt, 4.8' thickness		
Carbon #5	Tgs 3/		1.9 gpt, 7' thickness represented	3.1 gpt, 10.2' thickness		
Elizabeth #1	Between Tgs & Tgb	0.6 gpt, (Walker) 2' thick	0.3 gpt, 4' thickness represented	No oil, 1.9' thickness		
Elizabeth #2	Tgbf	9.2 gpt (Nielsen) 1' thick	Trace, 2.5' thickness represented	No oil, 3.6' thickness		
Elizabeth #3	Tgb	No oil, trace 1 gpt, (Kuehnel & Walker)	No oil; float	No oil, 6.3' thickness		
Elizabeth #4	Tgs		1.6 gpt, 2' thickness represented	2.2 gpt, 4.8' thickness	1.8 gpt, 8.9' thickness, Cut #4	Elizabeth #1: Tgc; 6.3 gpt, 13.5' thickness; 5.4 gpt, 36' thickness. Elizabeth #2: 6.4 gpt over 19.6' or 3.7 gpt over 43.2' thickness.
Elizabeth #5	Tgs		2.3 gpt, 6' thickness represented	1.8 gpt, 2.4' thickness		

APPENDIX C

COMPARISON OF ASSAY RESULTS

Name & Number of Claim	Tongue	Kuehnel	McIntosh & Meschter 1/	Montgomery & Goldenstein 2/	Other Samples	Drill Hole Information
Elizabeth #6						
North DP 4/	Tgb		--------------------	Trace, 5.7' thickness		
East DP	Tgb		Trace, 6' thickness represented	No oil, 6.4' thickness		
Elizabeth #7						
North DP	Tgb	4.0 & 4.5 gpt (Kuehnel & Walker) DP not specified	No oil, 2.5' thickness represented	No oil, 5.6' thickness		Tom Corehole: 0.3 gpt, 13' thickness
South DP	Tgbf		-------------------	No oil, 8.8' thickness		0.8 gpt, 15' thickness
Elizabeth #8	Tgb		0.2 gpt, 6' thickness represented	No oil, 6.4' thickness		
Elizabeth #9	Tgbf		Trace, 3' thickness represented	Trace, 3.6' thickness		
Elizabeth #10	Tgb		0.3 gpt, 2' thickness represented	0.1 gpt, 3.6' thickness		
Elizabeth #11						
West DP	Tgb		0.7 tpt, 4' thickness represented	Trace, 6.2' thickness		Stuart Corehole: Tgs--5.1 gpt, 25.7' thickness Tgc--1.8 gpt, 30.2' thickness
South DP	Tgb		------------------	No oil, 2.4' thickness		
Elizabeth #12	Tgs		4.1 gpt, 3' thickness represented	3.8 gpt, 8.5' thickness		

1/ Grab samples unless otherwise indicated

2/ Chip or channel samples at or near "discovery" point

3/ In 1925, Kintz sampled a 21' bed between cuts 4 and 5 which assayed 7.8 gpt
In 1931, Lewis and Williams sampled a 4' bed in cut #5 which assayed 13 gpt

4/ DP-----Discovery Point

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Elizabeth #10	Tgb		0.3 gpt, 2' thickness represented	0.1 gpt, 3.6' thickness		
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South DP	Tgb		--------------------	No oil, 2.4' thickness		
Elizabeth #12	Tgs		4.1 gpt, 3' thickness represented	3.8 gpt, 8.5' thickness		

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2/ Chip or channel samples at or near "discovery" point
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In 1931, Lewis and Williams sampled a 4' bed in cut #5 which assayed 13 gpt
4/ DP-----Discovery Point

APPENDIX D

PRESENT STATUS OF SHALE OIL INDUSTRY IN THE UNITED STATES

EXTRACT FROM: Gavin, M.J.; Hill, H.H.; and Perdew, W.E., Notes on the Oil Shale Industry with Particular Reference to the Rocky Mountain District, Bureau of Mines, 1919

PRESENT STATUS OF SHALE OIL INDUSTRY IN THE UNITED STATES

Up to the present time more than 100 companies have been organized for the purpose of developing or selling stock in oil-shale enterprises. Some of these are apparently essentially stock-selling organizations and are not likely to be especially helpful in developing the industry; others are really interested in making the industry a success and have been organized on a firm basis. Some of them have spent considerable time and money on experimental work with the aim of developing retorting processes other than the Scottish that will be satisfactory for American shales.

About 30 processes for retorting oil shales in this country have come to the attention of the Bureau of Mines. These processes are in various stages of development, ranging from those that are still in the laboratory stage to the various processes successful in Scotland which are expected to have the same success in treating American shales. In most of the processes so far proposed the retorts are vertical, some of them being modifications of the retorts used with success in Scotland. At a few plants horizontal retorts with conveyors have been installed. One company is now erecting a Pumpherston retort and is planning to give it a thorough trial on American shales. This type of retort is extensively used in Scotland.

None of the different retorts in this country have as yet been tried on a commercial scale. Probably the nature of the shale and the number and quality of products desired from both the shale and the oil will largely govern the selection of retort.

It may be that the retort most successful with many American shales will neglect to some extent the recovery of ammonium sulphate, and by a large daily capacity will produce oil enough to more than compensate for the loss of ammonia. The American shales are somewhat richer in oil, but, as a rule, contain less nitrogen than the Scotch shales and for that reason it is possible that best commercial results may be obtained by sacrificing complete extraction of oil and ammonium sulphate for increased capacity. The work of the United States Geological Survey indicates that the nitrogen content of Colorado, Wyoming, and Utah shales varies more or less directly with the oil yield, whereas the reverse holds for Scotch shales.

LOCATION OF PLANTS

The chief factors to be considered in choosing a site for a shale plant are as follows: quality and quantity of shale, proximity to shale beds, mining conditions of shale deposit, water supply, facilities for

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LOCATION OF PLANTS

The chief factors to be considered in choosing a site for a shale plant are as follows: quality and quantity of shale, proximity to shale beds, mining conditions of shale deposit, water supply, facilities for

disposing of spent shale, transportation facilities for the products, labor supply, labor housing, and market conditions. Of these, -

Transportation must be given serious consideration, provision be made for bringing in the machinery and equipment, some of which is very cumbersome, and for removing the crude shale oil or the refined products to the market;

A plentiful supply of water is absolutely necessary;

If possible the plant should be situated so that the spent shale can be easily removed by gravity.

At present the spent shale is a necessary nuisance, and its removal involves considerable expense. Extended efforts have failed to find a satisfactory use for it in Scotland. Small quantities have been tried in road and brick making in Scotland without success and the Scotch plants are marked by enormous dumps of the spent shale.

ESTIMATE OF COSTS

Reliable general estimates of the cost of oil-shale mining and treating cannot be made, as the costs depend so much on local and individual conditions, such as location, accessibility, and character of shale beds, methods of mining, cost and supply of labor, and distance to market. Also, as there are no shale plants working on a commercial scale in this country, it is impossible to estimate accurately the cost of such plants.

MINING

Some shale deposits may at first be mined with steam shovels. Such mining is much cheaper than underground work, but most of the deposits that can be mined to advantage in this way are in places more or less inaccessible at present. In estimates of general mining costs, it will be best to consider mining as entirely underground. There may be some special cases where costs will be much lower than the average for this type of mining, due to exceptionally favorable local conditions.

Probably the cost of mining shale will be about that of mining coal in the same general locality. As shale is tougher than coal it is, perhaps, more difficult to mine, but on the other hand, no attention need be paid to the proportion of fines made in blasting and for that reason more powder can be used. It is believed that with the present scale of wages, to mine, break and deliver shale to the retorts, will cost $1.50 to $2.50 a ton.

According to Dr. R. D. George, State Geologist of Colorado, in a statement at a hearing on oil shale before Assistant Secretary of the

Interior Vogelsang, January 25, 1918, the average cost of mining coal in Colorado at that time was $1.37 a ton. Undoubtedly this cost has increased since that time, with the general rise in cost of labor, materials, etc.

RETORTING

The cost of retorting will depend not only on local conditions, but also on the type of retorts or the retorting process employed and the scale of operation. It must be remembered that it is impossible to estimate such costs until plants have been running on a commercial scale long enough to give cost data on depreciation, repairs, replacements, etc. The pre-war cost of retorting in Scotland was about forty cents a ton, but to accept that figure, without modifications in making estimates of present charges, is not justifiable, as labor and material costs, even in Scotland, are much higher than they were before the war.

REFINING

The refining of shale oil will be more expensive than the equivalent refining of petroleum. There are so many different methods of obtaining refinery cost figures that a cost figure means little, if a statement is not made as to how it is obtained.

Until more is known regarding the properties of the oils produced from our American shales, and of the problems connected with their refining, it is not considered justifiable to assume that the cost of refining shale oil will be the same as the cost of refining petroleum in this country, or the refining of shale oil in Scotland. Emphasis should be drawn again to the fact that oils from different shales and those obtained by different retorts or conditions of retorting may have very different properties and call for different refining processes with different relative costs. Factors which have decided bearing on the costs of refining, aside from quality of the oil, are scale of operations and quality and quantity of products made.

The costs of refining shale oil in Scotland, given herewith, are for the present year (1919) and are not necessarily applicable to American conditions and American shale oils. Refining crude shale oil in one of the largest works in Scotland, manufacturing the following percentage of products, exclusive of plant depreciation and packing and shipment of products, costs approximately $1.05 per barrel of 42 U.S. gallons.

Products made are:

Naphtha (including scrubber naphtha)	9.9%	(450°end point)
Burning Oil	24.7%	
Gas & Fuel Oil	24.4%	
Lubricating Oil	6.6%	

Wax	9.5%
Loss (including still coke 2%)	24.9%
	100.0%

Attention is called to the high refining loss and to the fact that the lubricating oils, by reason of their low viscosity, command a considerably lower price than lubricants made from petroleum.

It must be remembered that considerable skill and experience will be needed to produce many different marketable products from shale oil and expensive equipment and trained men will be necessary for making lubricating oils and paraffin. Possibly those starting in the industry may plan on partly refining the oil and marketing only motor fuel, fuel oil and ammonium sulphate, and after they become familiar with handling the oil, put in equipment for making lubricating oils and wax.

In refining shale oil, conditions are somewhat different than in refining petroleum, as the gasoline content of the oil is relatively low and, in Scotland, the wax has furnished the most valuable product from the oil. Too much emphasis cannot be laid on the fact that the manufacture of good lubricating oils requires men of extensive training and experience, that the manufacture of lubricating oils from shale oil will demand a great deal of research and experimental work before it can be established as a successful industry, and that it may never be possible to make the more viscous grades of lubricants from shale oil.

AMMONIUM SULPHATE

The cost of producing ammonium sulphate will depend on a number of variables. The method of retorting, nitrogen content of the shale, cost of sulphuric acid, and transportation charges on this acid must be considered. In Scotland the pre-war cost of fixing ammonia as ammonium sulphate, was about 0.7 cents a pound, exclusive of interest on plant investment as well as of mining and retorting costs. As the American shales generally contain a somewhat lower percentage of nitrogen, and the other costs are higher, it is reasonable to believe that the cost of producing ammonium sulphate in this country will be higher than in Scotland.

BY-PRODUCTS

In Scotland little attention has been paid to possible by-products, since a ready market exists for the ordinary distillation products of shale oil and ammonium sulphate. The latter is the only by-product produced to any extent from the Scotch shales, but is extremely important in the success of the Scotch industry.

Little is known of the possibilities of by-products from American

shales. There is a possibility that by-products may be obtained that will increase considerably more the sales value of the products from shale than could be expected from oil and ammonium sulphate alone. The by-products should be given serious study, involving questions of qualities, quantities, commercial methods of producing and costs, and particularly market conditions of value and demand. These questions should be most thoroughly studied from both the technical and economic phases before any possible by-products should be used in estimating values for a shale oil plant. A by-product is what the name implies, i.e., something produced as a side issue from a main product, and by-products have generally been the outgrowth in the later stages of an industry firmly established upon its main products. In some industries the by-products have become the main products and the original main product, the by-product, but only after long and thorough research work and experimentation, coupled frequently with increased value of the by-products.

MARKETING SHALE-OIL PRODUCTS

The difficulties that are likely to be encountered in marketing oil-shale products must be given consideration. The petroleum industry of this country, established for many years, has developed an extensive and efficient system of marketing its products. Before shale-oil products can become of commercial importance it may be necessary to carry on a campaign of education in order to convince the public that such products can be used with the same degree of satisfaction as those obtained from petroleum.

The marketer of petroleum products has a distinct advantage through the largest oil refineries being located either on the seaboard or near the marketing centers, whereas it seems that the shale oil refineries will be located largely in the Rocky Mountain region.

Until the shale oil industry has assumed large proportions it must depend upon local markets under the local competitive conditions that prevail during that period. At the present time the chief competition will be from products obtained from the oils of the Wyoming oil fields which marketed over 12,000,000 barrels of high grade crude oil in 1918, selling at \$1.50 to \$1.80 a barrel at the well. The oil shale plants in Scotland are located very favorably, for they are near the two largest cities of Scotland and compete with petroleum products that must be imported from the United States and other foreign countries.

FUTURE POSSIBILITIES OF THE OIL SHALE INDUSTRY IN THE UNITED STATES

The future of the oil-shale industry in this country depends largely on the relative supply and demand for petroleum products, particularly

in the Rocky Mountain district. There is a strong probability that in years to come the production of petroleum may so decrease and the demand so increase that oil shales may be largely needed to supply the deficit of crude petroleum as a source of refined products.

The oil shales of this country contain enormous quantities of oil, but large amounts of money will have to be invested before the oil shale industry becomes of commercial importance. Estimates by various engineers of the cost of a complete retorting plant, handling 1,000 tons of shale a day, are between $1,000,000 and $5,000,000, and if the average shale treated yielded 42 gallons of oil a ton it would probably require at least 1,300 such plants to supply the volume of crude oil that is being consumed in this country today, and the shale mined daily would amount to approximately one half the coal mined daily in this country. However, it is hardly to be expected that shale oil will be called upon to replace petroleum completely, for a great many years. Although the Scotch industry has been existent for more than 50 years, the amount of shale oil produced in Scotland during the calendar year of 1916 was less than three days' average production of crude oil in the United States during the same year.

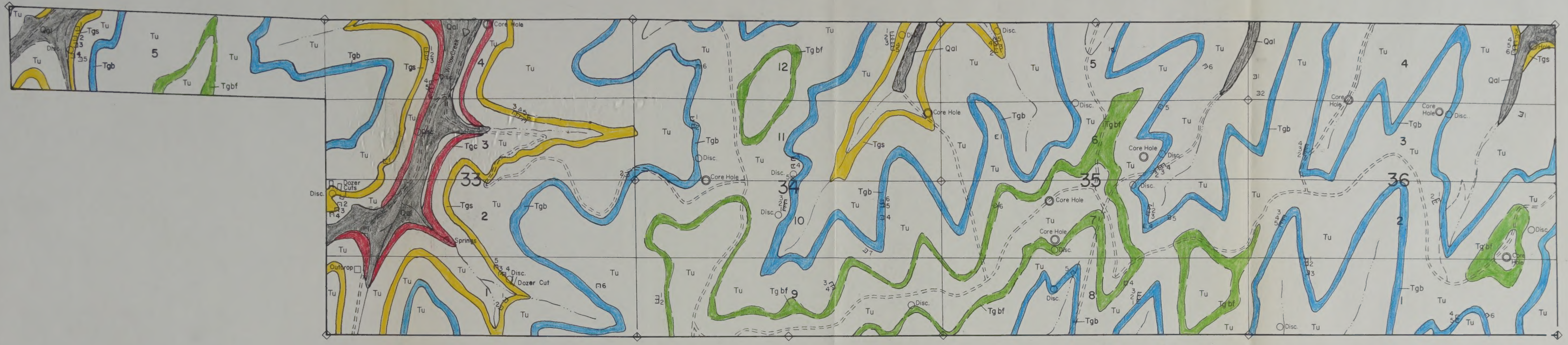
The oil-shale industry is not strictly comparable to the petroleum industry. It is a completely new industry for this country and calls for new training and experience. After the oil has been removed from the shale the problems connected with its refining are much more complex than are those of refining petroleum. Obtaining oil from shale is not comparable to obtaining crude oil by drilling. In drilling an oil well the element of chance has to be taken into consideration, but there is always the possibility of a large immediate reward on a relatively small investment. After oil has been struck, the cost of transporting it to the refinery is in most cases relatively small, as there are systems of pipelines throughout the oil fields.

In producing oil from shale the original cost of the shale in place is practically nothing at present. Estimating the supply of oil recoverable from a given tract involves little difficulty, for a few test holes and analyses can establish the thickness and the richness of the bed in a similar manner as the value and extent of a coal deposit is estimated.

It must be realized that the production of oil from oil shale is a large-scale manufacturing enterprise that involves the handling of large amounts of low-grade material and is comparable in many respects to the extraction of gold or copper from low-grade ores. The original investment for equipment is heavy, the operating expenses high, the profit per ton probably small, and a large daily capacity and good management are essential for profits.

In this country the oil-shale industry cannot be developed overnight and probably cannot attain success until large sums of money have been spent in perfecting mining, retorting, and refining methods. A

company to be successful, whenever oil-shale operations become commercially feasible, must be able to employ the best technical, business, and engineering skill available, be prepared to operate on a large scale, be financially strong enough to wait several years for any large return on the money invested. A large amount of credit will naturally be due those pioneering companies that will carry development work so far what whenever the petroleum industry fails to meet the demands for its products the oil shale industry will be in a position to make up the deficit. It is unfortunate that a number of the many companies organized to deal with oil shale are devoting their efforts to stock-selling rather than assisting in building a firm basis for the industry.


33
34
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4
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6
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Tu
Tgb
Tgbf
Tgs
Tgc
Qal
Core Hole
Disc.
Dozer Cuts
Dozer Cut
Springs
Outcrop
Willow Creek

Carbon 1-5

Elizabeth 1-12

T.4S., R.97W., 6th P.M.,
Garfield County, Colo.

⊏ Cuts
○ "Discovery" Points
◇ Found Survey Corner

B.L.M. - Colo. State Office

Mineral Patent Application C030979
by
Wasatch Development Co.

Geologic Map Units

Qal Alluvium

Tu Uinta Formation

Green River Formation

- Tgbf Marlstone at Bull Fork
- Tgb Marlstone at Barnes Ridge
- Tgs Marlstone at Stewart Gulch
- Tgc Marlstone of Coughs Creek Tongue

Geology adapted from Preliminary Geologic Maps of Cutoff Gulch and Bull Fork Quads, U.S.G.S.

Cuts and Discovery Points plotted from Tom Walker's map submitted with Patent Application.

APPENDIX F

EXHIBIT

PHOTOGRAPHS

CARBON I

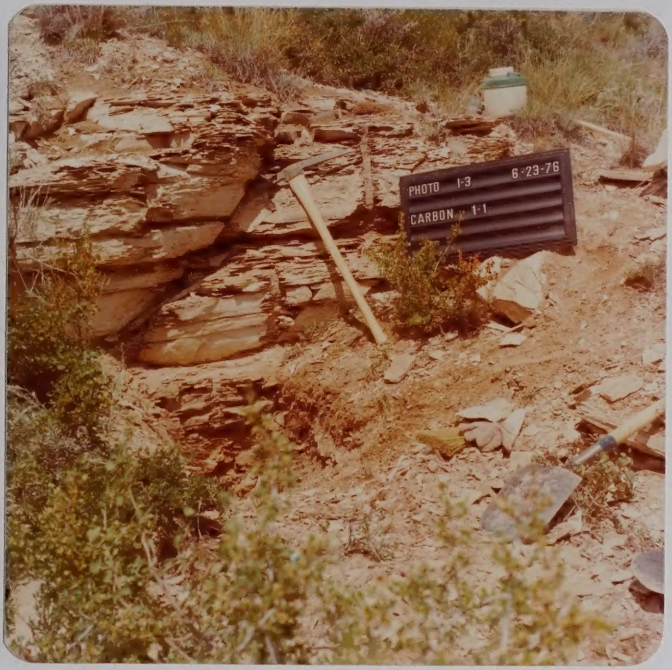
PHOTO 1-3
6-23-76
CARBON 1-1

Photo 1-3 (SJG)
Sample Point, Carbon 1-1 "Discovery" Point

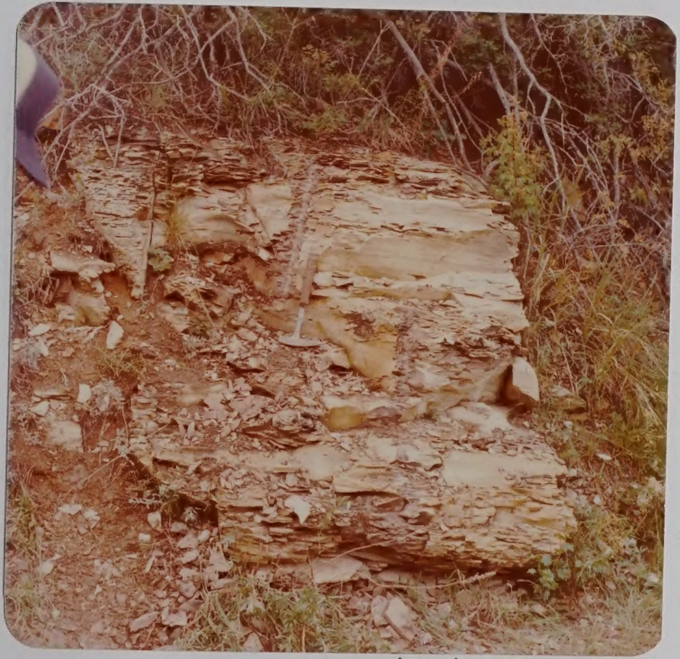

Photo 1-2 (SJG)
Carbon 1, Sample Point, Carbon 1-2

CARBON 1

Photo 1-4 (EHM)
Cuts 3-5 And Dozer Cut Carbon 1 Looking N 15° E

Photo 1-2 (EHM)
Looking S At Cuts 1 And 2 From Cut 5

CARBON 2

PHOTO 1-5 6-24-76
CARBON 2-1

Photo 1-5 (SJG)
"Discovery" Point Carbon #2

PHOTO 1-4 6-24-76
CARBON 2-2

Photo 1-4 (SJG)
Carbon 2 Sample Carbon 2-2, Ledge 50' Above Sample Point

CARBON 2

Photo 1-5 (EHM)

Looking N 20° W Toward NW Corner Carbon 2
From Cut #1, Discovery Point In Bottom Of Draw
Sample Carbon 2-2 From Workings On The Left

Photo 1-6 (EHM)
Look S 30° E At Ledge (Tgc) On Carbon 2

CARBON 3

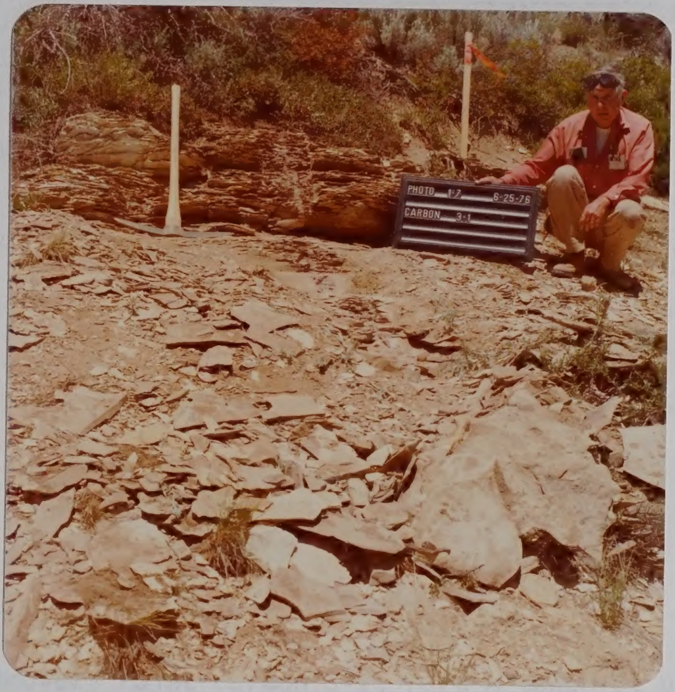
PHOTO 1-7
6-25-76
CARBON 3-1

Photo 1-7 (SJG)
Discovery Point Carbon 3-1 A

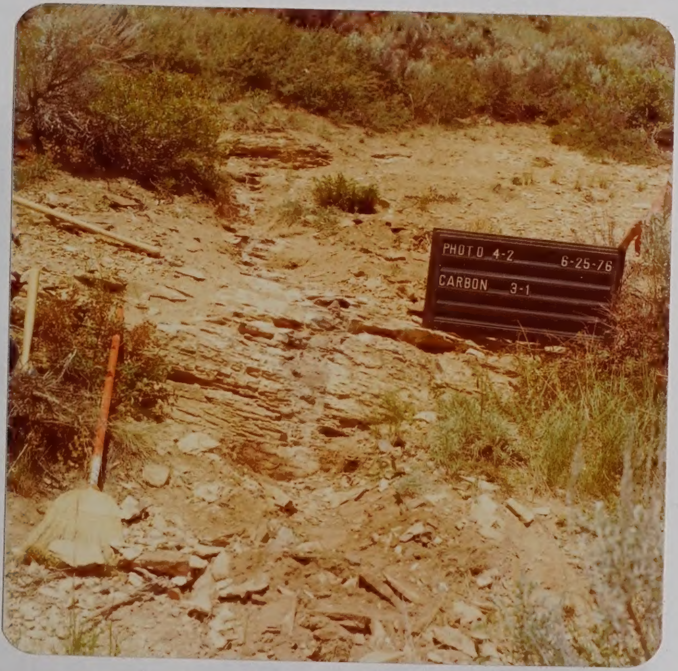
PHOTO 4-2
6-25-76
CARBON 3-1

Photo 4-2 (EHM)
Discovery Point Carbons 3-1 B And C

CARBON 3

Photo 4-1 (EHM)
Discovery Point Carbon 3-1; Part A taken at upper right; Parts B and C Lower Center

CARBON 4

Photo 1-8 (SJG)
Carbon 4 discovery point before sampling

CARBON 4

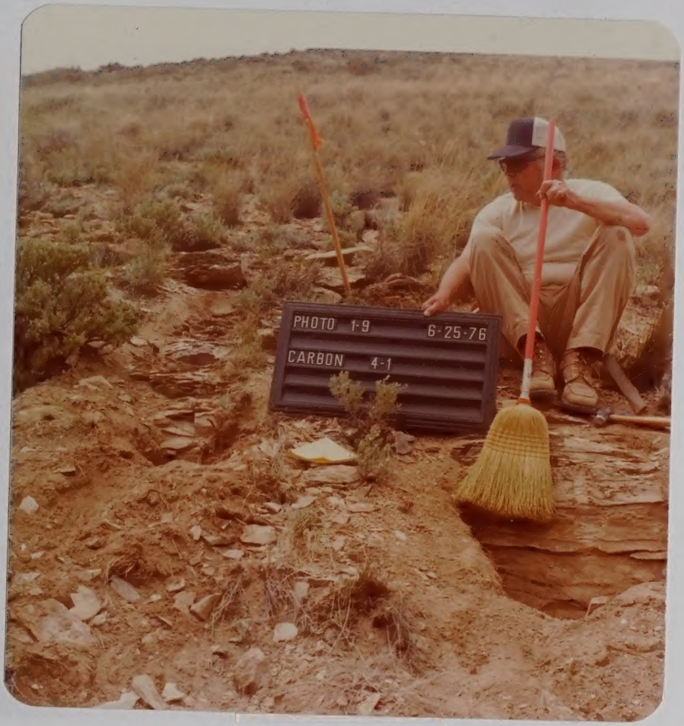
PHOTO 1-9 6-25-76
CARBON 4-1

Photo 1-9 (SJG)
Carbon 4, "Discovery" Point

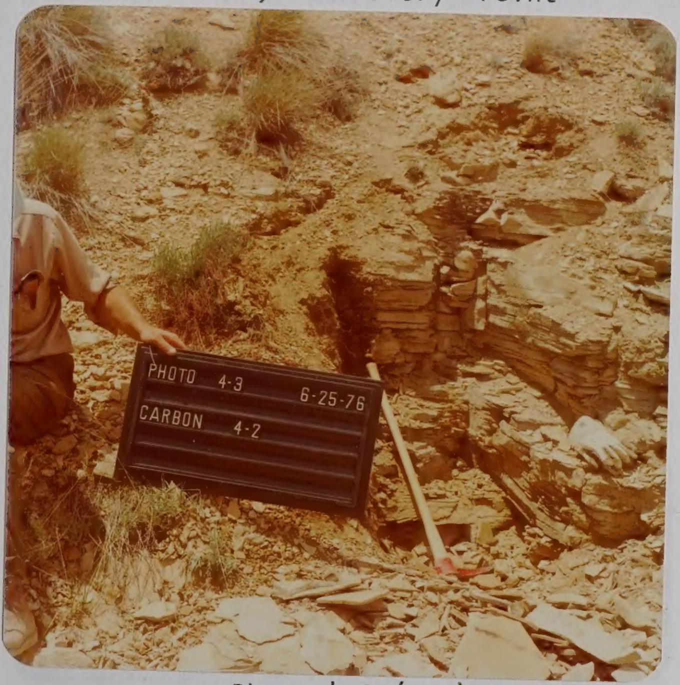
PHOTO 4-3 6-25-76
CARBON 4-2

Photo 4-3 (EHM)
Carbon 4-1

CARBON 4

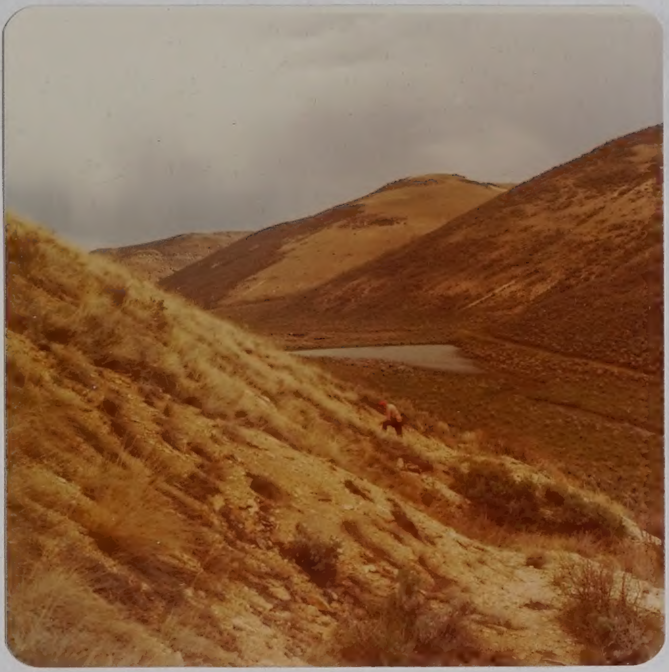

Photo 1-11 (EHM)
Looking N 40° E From South Of Cut 6 Toward Cut 4

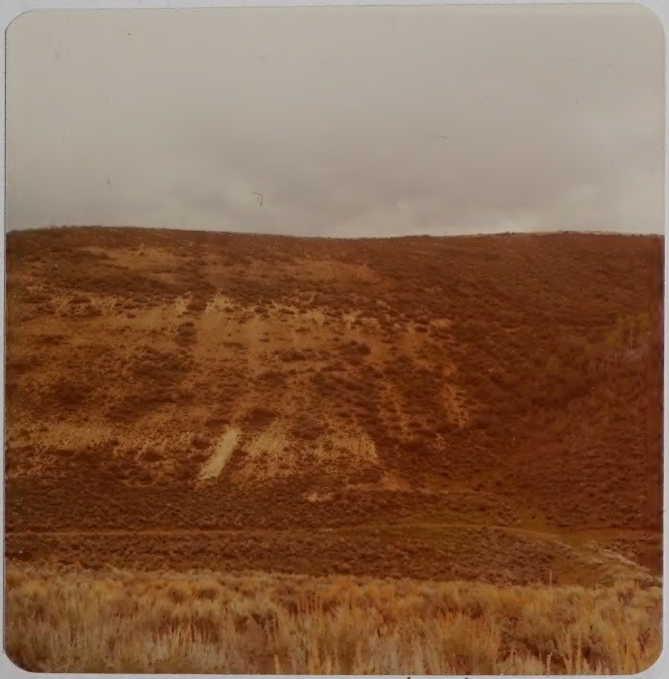

Photo 1-12 (EHM)
Looking East Toward Hillside On Carbon 4,
Faint Outcrop Of Tongues Tgc And Tgs (Upper)

CARBON 5

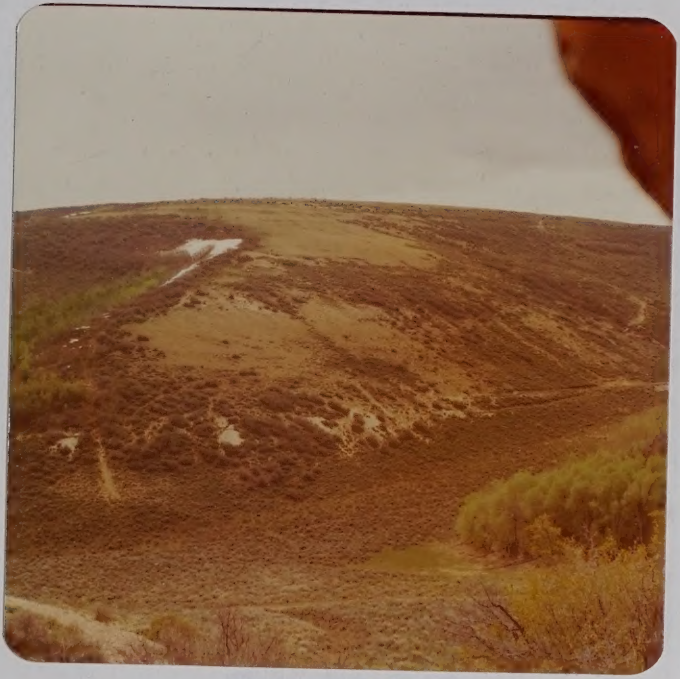

Photo 1-8 (EHM)
Looking S 50° E Toward Cuts 1 (Lower Left), 2, 3, And 4, Lower Right And 5, Upper

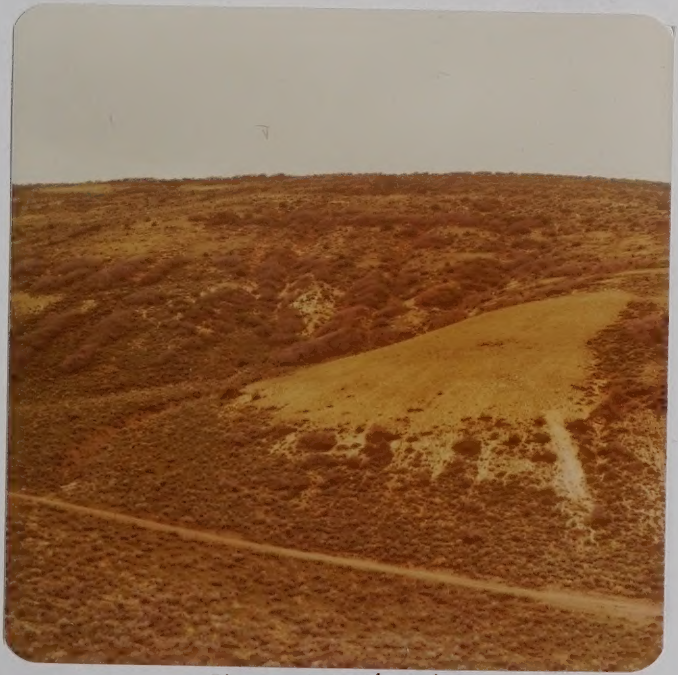

Photo 1-9 (EHM)
Looking Westerly At Dozer Cut And NW Corner Carbon 5 From Cut 1

CARBON 5

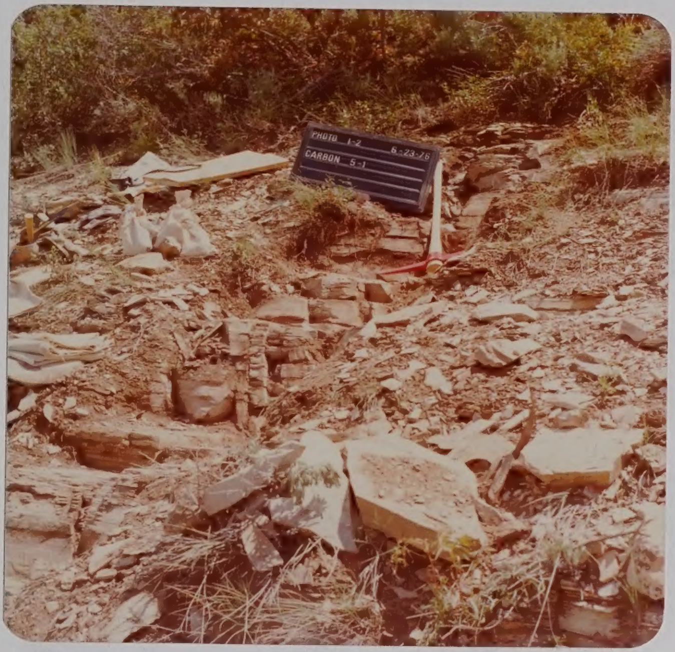
PHOTO 1-2 6-23-76
CARBON 5-1

Photo 1-2 (SJG)
Discovery Point Carbon 5-1 Sampled In Parts A, B, And C

Photo 1-10 (EHM)
Looking East At Cuts 1 (Left), 2, 3, 4 (Right)
Discovery Point Between 3 And 4

ELIZABETH 1

PHOTO2-3
ELIZABETH 1-1

Photo 2-3 (SJG)
Discovery Point Elizabeth 1-1 On East Edge Of Draw

Photo 2-5 (SJG)
Bulldozer Cut About 150' North Of Discovery Point

ELIZABETH 2

PHOTO 2-6 7-15-76
ELIZABETH 2-1

Photo 2-7 (SJG) (Marked 2-6)
Discovery Point Elizabeth 2-1

Photo 3-3 (EHM)
Dozer Cut At Sample Point Elizabeth 2-1, Before Sampling

ELIZABETH 3

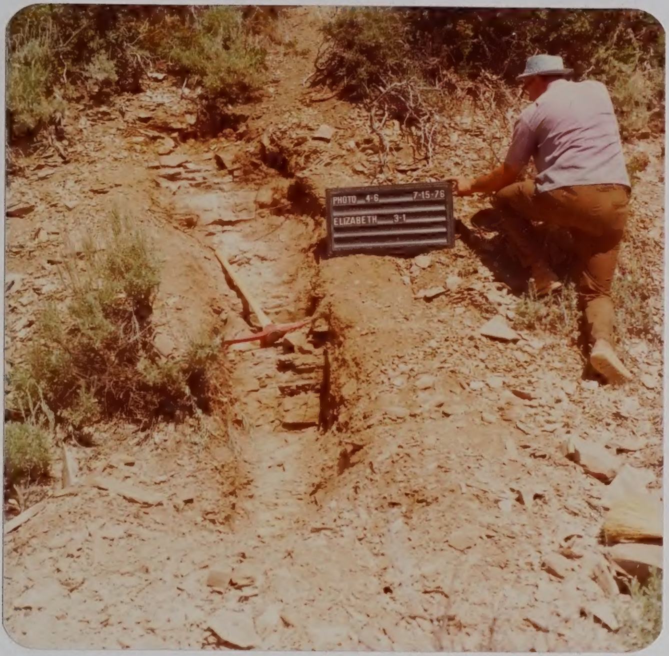
PHOTO 4-6
7-15-76
ELIZABETH 3-1

Photo 5-6 (EHM) (Marked 4-6)
Sample Cut At Discovery Point Elizabeth 3

Photo 3-2 (EHM)
Dozer Cut On Elizabeth 3

ELIZABETH 4

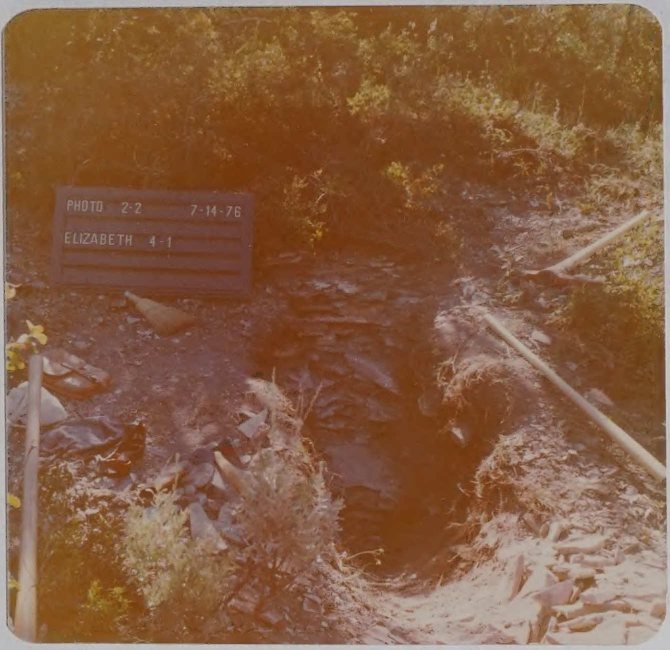
PHOTO 2-2 7-14-76
ELIZABETH 4-1

Photo 2-2 (SJG)
Sample Cut At Discovery Point Elizabeth 4-1

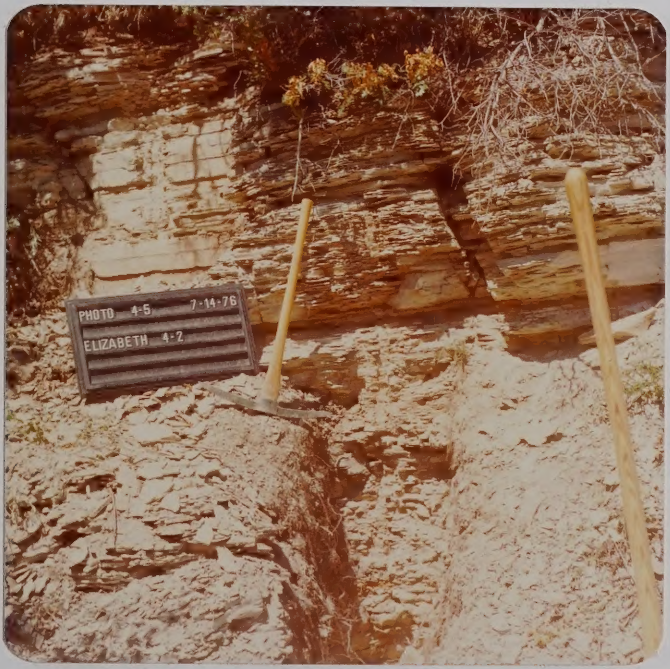
PHOTO 4-5 7-14-76
ELIZABETH 4-2

Photo 5-5 (EHM) (Marked 4-5)
Sample Cut At Sample Point #2, Elizabeth 4 (Cut #4)

ELIZABETH 4

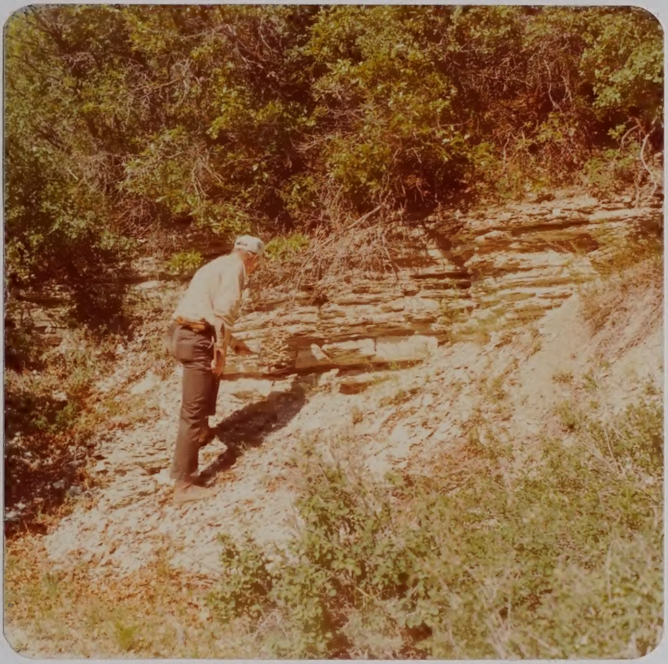

Photo 2-12 (EHM)
Cut #4 On Elizabeth 4, Look S 60° W

ELIZABETH 5

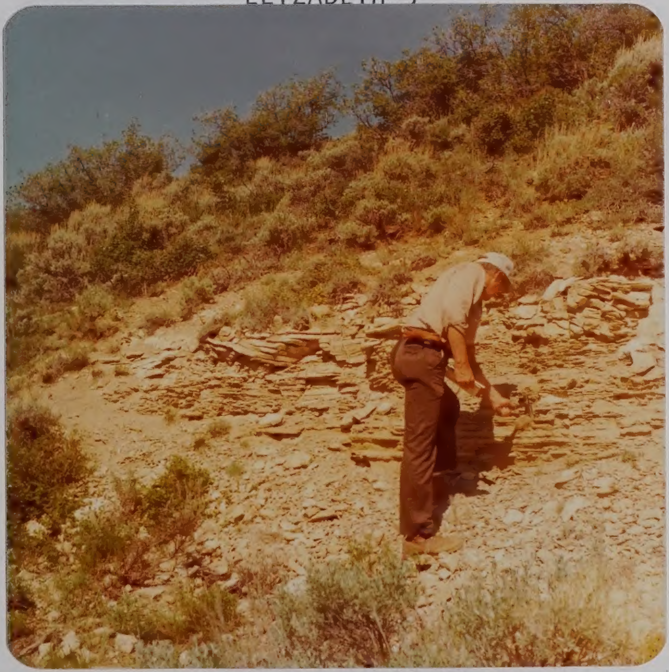

Photo 2-10 (EHM)
Cut #6, Elizabeth 5, Looking S 85° W

ELIZABETH 5

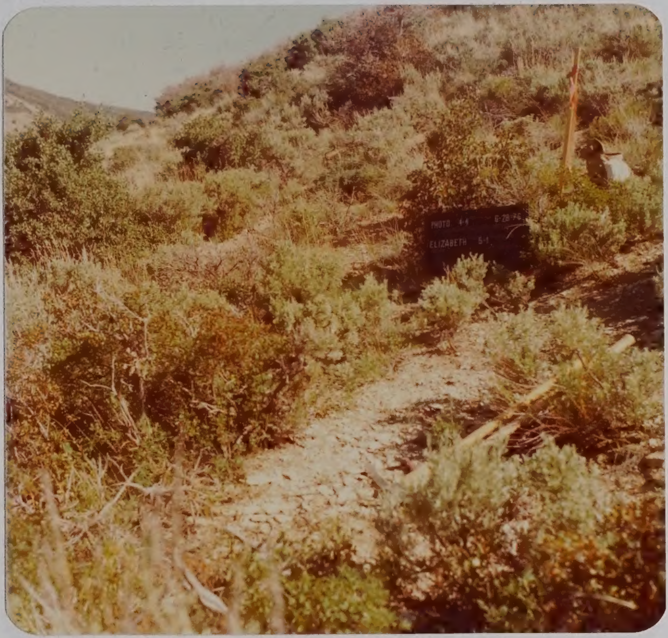
PHOTO 4-4 6-28-76
ELIZABETH 5-1

Photo 4-4 (EHM)
Indicated Discovery Point Before Sampling

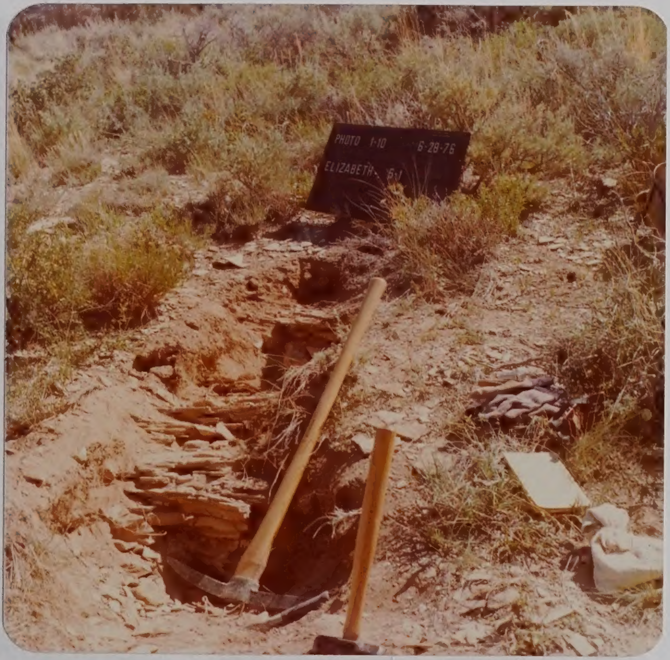
PHOTO 1-10 6-28-76
ELIZABETH 5-1

Photo 1-10 (SJG)
Sample Cut At Indicated Discovery Point Elizabeth 5-1

ELIZABETH 6

Photo 2-5 (EHM)
Dozer Cut At Indicated Discovery Point, Elizabeth 6

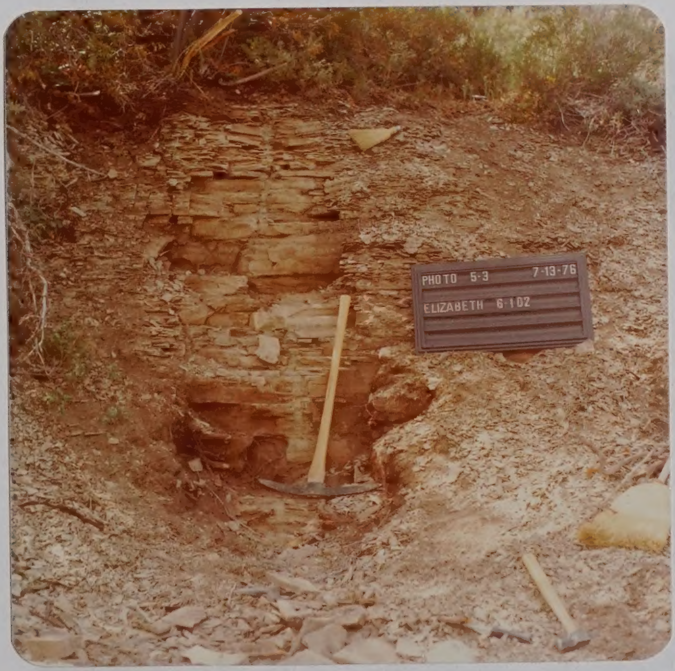
PHOTO 5-3 7-13-76
ELIZABETH 6-1 02

Photo 5-3 (EHM)
Sample Cut At Second Indicated Discovery Point (Eastern)
Elizabeth 6-1-2

ELIZABETH 6

PHOTO 5-1 7-13-76
ELIZABETH 6-1 D1

Photo 5-1 (EHM)
Sample Cut At Indicated Northern Discovery Point, Elizabeth 6-1-1

ELIZABETH 7

PHOTO 5-2 7-13-76
ELIZABETH 7-1 D2

Photo 5-2 (EHM)
Sample Cut At Second Indicated Discovery Point
Elizabeth 7-1-2D, North Part Of Claim

ELIZABETH 7

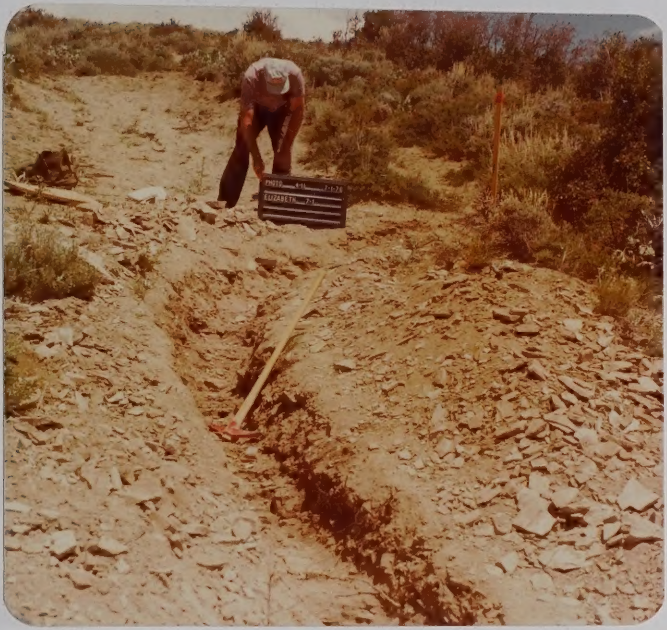

Photo 4-11 (EHM)
Sample Cut At Indicated Discovery Point, Elizabeth 7-1-1, S Edge of Claim

Photo 2-7 (EHM)
Dozer Cut Before Above Sample Was Taken, Elizabeth 7

ELIZABETH 8

Photo 2-11 (EHM)
Looking S 50° E At Sidehill, Elizabeth 8, Showing Sandstone Ledges Outcropping Beneath Tgbf And Tgb

Photo 2-6 (EHM)
Dozer Cut And Indicated Discovery Point On Elizabeth 8, Looking North

ELIZABETH 8

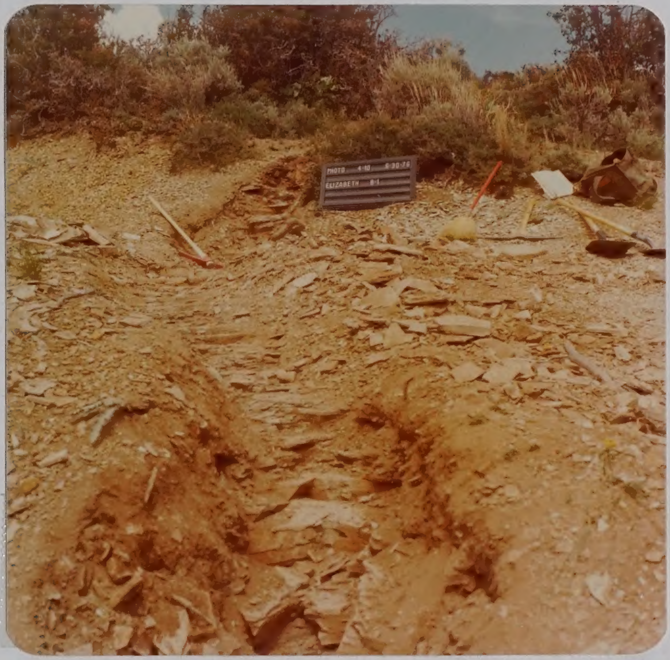
PHOTO 4-10 6-30-76
ELIZABETH 8-1

Photo 4-10 (EHM)
Sample Cut At Indicated Discovery Point, Elizabeth 8-1

ELIZABETH 9

Photo 4-8 (EHM)
Indicated Discovery Was Apparently Where This Stockpond Was Constructed

ELIZABETH 9

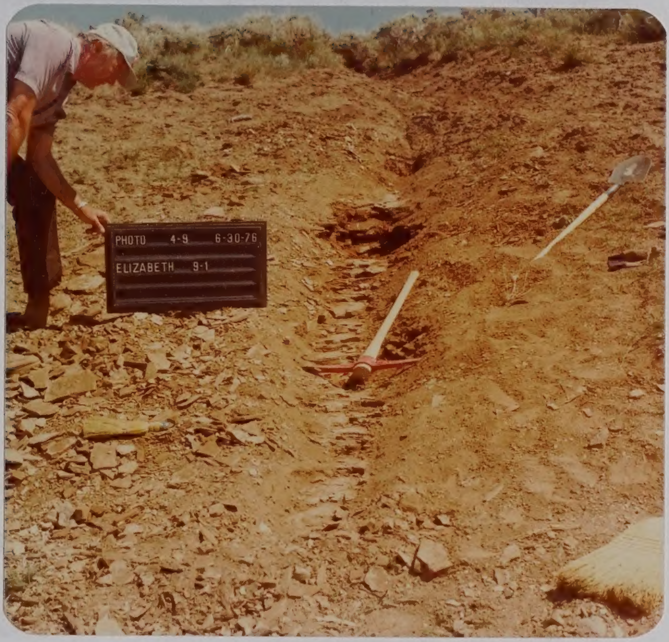
PHOTO 4-9 6-30-76
ELIZABETH 9-1

Photo 4-9 (EHM)
Sample Cut In Edge Of Stockpond Where
The Indicated Discovery Point Was Located

Photo 2-4 (EHM)
Looking N 35° W At Cuts On Elizabeth 10 And 11

ELIZABETH 10

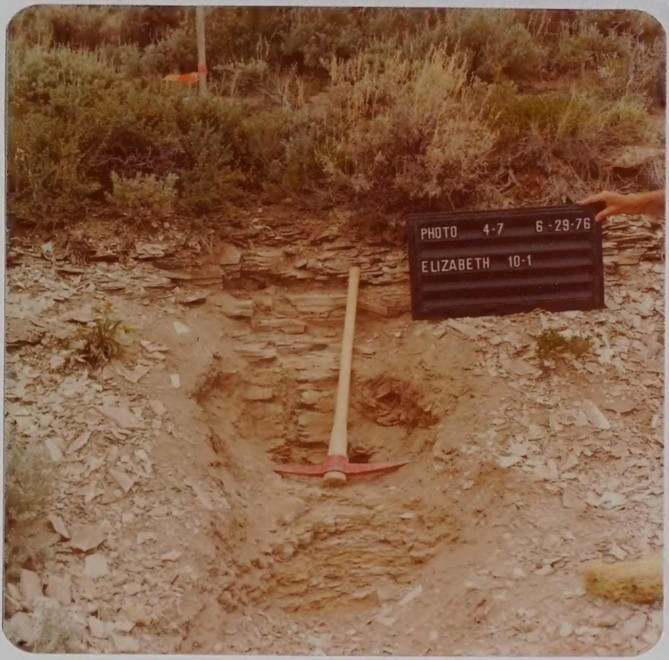
PHOTO 4-7 6-29-76
ELIZABETH 10-1

Photo 4-7 (EHM)
Sample Point At Indicated Discovery, Elizabeth 10

Photo 2-2 (EHM)
Looking 70° W At Cuts 5 And 6, Elizabeth 10

Elizabeth 11

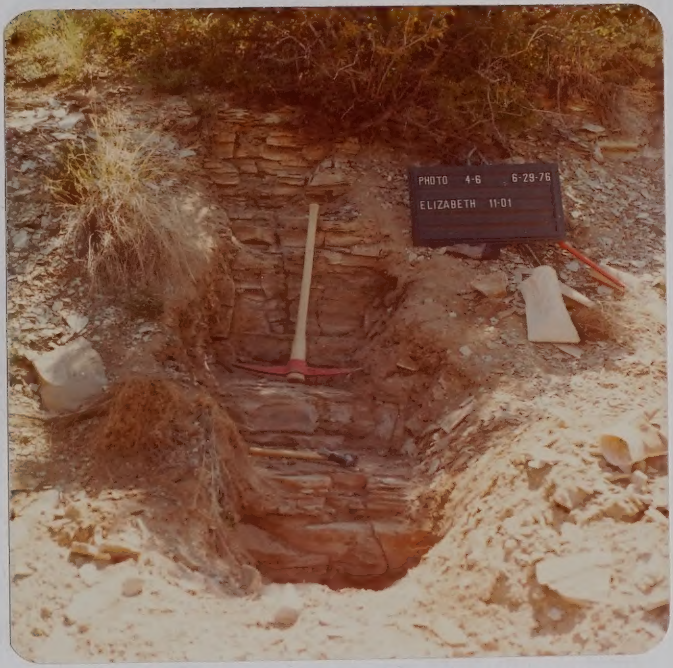
PHOTO 4-6 6-29-76
ELIZABETH 11-01

Photo 4-6 (EHM)
Sample Point Of Indicated Western Discovery, Elizabeth 11

Photo 2-1 (EHM)
Cut 6 On Elizabeth 11, Looking S 65° W

ELIZABETH 12

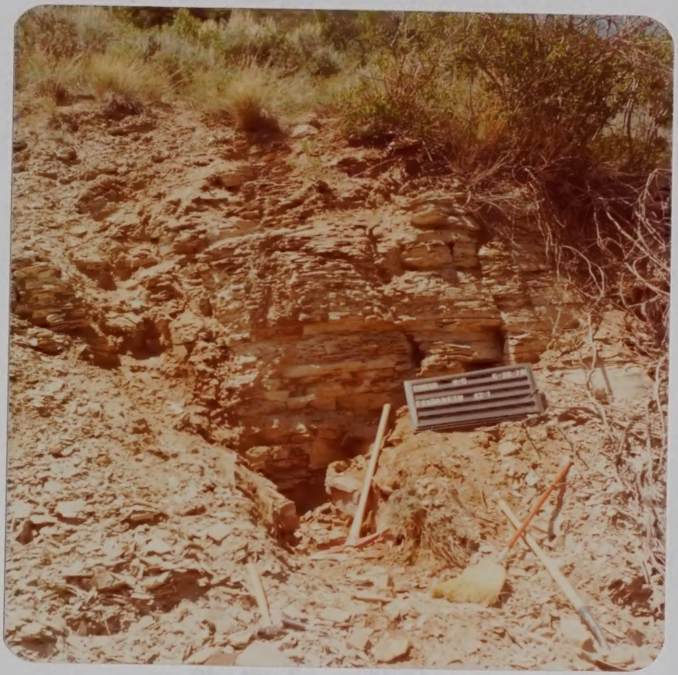

Photo 4-5 (EHM)
Sample Point At Indicated Discovery On Elizabeth 12

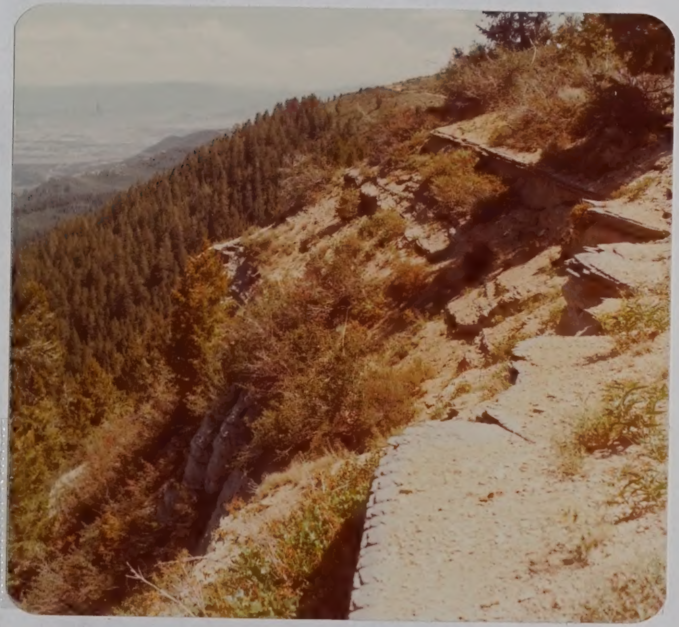

Photo 5-7 (EHM)
Showing Typical Outcrop And Color Of Rich Oilshale (Roan Cliffs)

Negative misplaced. Unable to
obtain prints for copies of report.

Photo 5- (EHM)
Showing Typical Mahogany Ledge Outcrop Along
Roan Cliffs On East Edge, Piceance Creek Basin

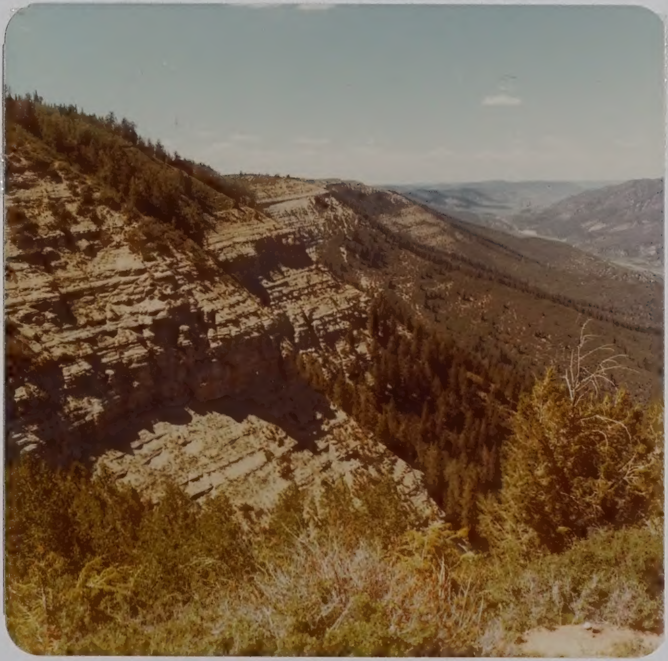

Photo 5-10 (EHM)
Showing Typical Mahogany Ledge Outcrop Along
Roan Cliffs On East Edge, Piceance Creek Basin

910

DEPT OF INTERIOR
BUR LAND MANAGEMENT
COLO STATE OFFICE, DENVER
19 AUG 76 AM 10:00

APPENDIX G

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
P.O. BOX 3395, UNIVERSITY STATION
LARAMIE, WYOMING 82071

LARAMIE ENERGY
RESEARCH CENTER

August 17, 1976

Mr. John Goldenstein
Bureau of Land Management
Colorado State Office
1600 Broadway
Denver, Colorado 80202

Dear John:

Enclosed are 2 copies of oil-yield assay results obtained in duplicate on the samples you left with us July 27 for assay. As before, the initial sheet gives the results of the individual oil-yield assays, and the final sheet, verified by Greg Coates, gives average results of the individual assays.

We kept your bags and the samples. You're welcome to both.

Sincerely yours,

Ward

John Ward Smith
Research Supervisor

JWS:jkg

Enclosures:
As stated

OIL-SHALE ASSAYS BY MODIFIED FISCHER RETORT METHOD

Special surface samples submitted by the Bureau of Land Management, Denver.
Samples were collected in T 4 S, R 97 W, Garfield County, Colorado

Sample number		Yield of product						Specific gravity of oil at 60°/60° F	Properties of spent shale	Remarks
		Weight percent				Gal per ton				
Laramie	Their	Oil	Water	Spent shale	Gas + loss	Oil[1/]	Water		Tendency to coke	
SBR76-831xa	Eliz. 1-1	0.0	5.3	94.1	0.6	No Oil	12.6		None	
SBR76-831xb	Eliz. 1-1	.0	5.9	93.0	1.1	No Oil	14.2		None	
SBR76-832xa	Eliz. 2-1	.0	3.5	96.0	.5	No Oil	8.3		None	
SBR76-832xb	Eliz. 2-1	.0	3.8	95.2	1.0	No Oil	9.1		None	
SBR76-833xa	Eliz. 3-1	.0	5.4	93.8	.8	No Oil	13.0		None	
SBR76-833xb	Eliz. 3-1	.0	4.4	93.9	1.7	No Oil	10.5		None	
SBR76-834xa	Eliz. 4-1	.7	3.8	94.6	.9	1.8a	9.1		None	
SBR76-834xb	Eliz. 4-1	.9	3.9	94.2	1.0	2.5a	9.3		None	
SBR76-835xa	Eliz. 4-2	.6	4.6	94.1	.7	1.6a	11.0		None	
SBR76-835xb	Eliz. 4-2	.8	4.8	94.0	.4	2.0a	11.5		None	
SBR76-836xa	Eliz. 6-1-1	.0	5.1	93.5	1.4	Trace	12.3		None	
SBR76-836xb	Eliz. 6-1-1	.0	4.7	95.1	.2	Trace	11.4		None	
SBR76-837xa	Eliz. 6-1-2	.0	4.3	93.2	2.5	No Oil	10.4		None	
SBR76-837xb	Eliz. 6-1-2	.0	4.5	92.8	2.7	No Oil	10.9		None	
SBR76-838xa	Eliz. 7-1-2D	.0	6.1	93.0	.9	No Oil	14.7		None	
SBR76-838xb	Eliz. 7-1-2D	.0	6.4	93.0	.6	No Oil	15.3		None	

See footnote at end of table.

Samples received July 27, 1976; assays made on air-dried samples

Laramie Energy Research Center, Laramie, Wyoming Illustration No. SBR-4829P Sheet 1 of 2 August 3, 1976

OIL-SHALE ASSAYS BY MODIFIED FISCHER RETORT METHOD

Average Fischer Assay Results for BLM Samples

Sample number		Yield of product						Specific gravity of oil at 60°/60° F	Properties of spent shale	Remarks
		Weight percent				Gal per ton			Tendency to coke	
Laramie	Their	Oil	Water	Spent shale	Gas + loss	Oil 1/	Water			
SBR76-831x	Eliz. 1-1	0.0	5.6	93.6	0.8	No Oil	13.4		None	sec. 36, SWSW
SBR76-832x	Eliz. 2-1	.0	3.7	95.6	.7	No Oil	8.7		None	sec. 36, NESE
SBR76-833x	Eliz. 3-1	.0	4.9	93.8	1.3	No Oil	11.8		None	sec. 36, SENE
SBR76-834x	Eliz. 4-1	.8	3.8	94.4	1.0	2.2a	9.2		None	sec. 36, NENE
SBR76-835x	Eliz. 4-2	.7	4.7	94.0	.6	1.8a	11.3		None	sec. 36, NENE
SBR76-836x	Eliz. 6-1-1	.0	4.9	94.3	.8	Trace	11.9		None	sec. 35, NWNE
SBR76-837x	Eliz. 6-1-2	.0	4.4	93.0	2.6	No Oil	10.6		None	sec. 35, SENE
SBR76-838x	Eliz. 7-1-2D	.0	6.2	93.0	.8	No Oil	15.0		None	sec. 35, NWSE

Analyses supervised by:

Gregory A. Coates

Gregory A. Coates, Assay Lab Supervisor

1/ "a"--indicates specific gravity estimated as 0.92.

Samples received July 27, 1976; assays made on air-dried samples

Laramie Energy Research Center, Laramie, Wyoming Illustration No. SBR-4829P Sheet 2 of 2 August 3, 1976

910

DEPT OF INTERIOR
BUR LAND MANAGEMENT
COLO STATE OFFICE, DENVER
'76 JUL 19 AM 10:00

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
P. O. BOX 3395, UNIVERSITY STATION
LARAMIE, WYOMING 82071

LARAMIE ENERGY
RESEARCH CENTER

July 16, 1976

Mr. Dale R. Andrus, State Director
Bureau of Land Management
Colorado State Office
Rm. 700, Colo. State Bank Bldg.
1600 Broadway
Denver, Colorado 80202

Dear Dale:

Enclosed are three copies of the data sheets (SBR-4823P, 3 sheets) reporting oil-yield assays on samples from the Carbon and Elizabeth group of claims delivered to us by Messrs. Montgomery and Goldstein. Oil-yield assay results of two determinations on each sample are given on the first two sheets. Average results of these duplicate determinations are entered on the third sheet together with a responsibility acknowledgement signed by Gregg Coates, the Assay Lab Supervisor. Under the oil-yield column, in gallons per ton, the words "no oil" means that no oil was detectable. The word "trace" signifies that oil was detected and appeared in quantities too small to round to 0.1 weight percent.

The sample locations are given with the average assay results on sheet 3 of Illustration SBR-4823P.

We hope these data meet your needs.

Sincerely yours,

Ward

John Ward Smith
Research Supervisor

JWS:mer

Enclosure:
As stated

OIL-SHALE ASSAYS BY MODIFIED FISCHER RETORT METHOD

Special surface samples submitted by the Bureau of Land Management, Denver.
Samples were collected in T 4 S, R 97 W, Garfield County, Colorado.

Sample number		Run No.	Yield of product						Specific gravity of oil at 60°/60° F	Properties of spent shale	Remarks
			Weight percent				Gal per ton				
Laramie	Their		Oil	Water	Spent shale	Gas + loss	Oil[1/]	Water		Tendency to coke	
SBR76-650Xa	Eliz. 5-1	22293	0.7	3.4	95.3	0.6	1.8a	8.1		None	
SBR76-650Xb	Eliz. 5-1	22294	.7	3.3	95.5	.5	1.9a	7.9		None	
SBR76-651Xa	Eliz. 7-1	22295	.0	4.9	94.6	.5	No Oil	11.7		None	
SBR76-651Xb	Eliz. 7-1	22296	.0	4.8	94.5	.7	No Oil	11.6		None	
SBR76-652Xa	Eliz. 8-1	22297	.0	5.8	93.4	.8	No Oil	14.0		None	
SBR76-652Xb	Eliz. 8-1	22298	.0	6.0	92.7	1.3	No Oil	14.4		None	
SBR76-653Xa	Eliz. 9-1	22299	.0	5.7	93.6	.7	Trace	13.7		None	
SBR76-653Xb	Eliz. 9-1	22300	.0	5.8	93.5	.7	Trace	14.0		None	
SBR76-654Xa	Eliz. 10-1	22301	.0	3.9	95.4	.7	Trace	9.3		None	
SBR76-654Xb	Eliz. 10-1	22302	.1	3.8	95.3	.8	.2a	9.1		None	
SBR76-655Xa	Eliz. 11-1-1	22303	.0	5.0	94.5	.5	Trace	11.9		None	
SBR76-655Xb	Eliz. 11-1-1	22304	.0	5.0	93.8	1.2	Trace	11.9		None	
SBR76-656Xa	Eliz. 12-1A	22375	2.0	2.6	94.7	.7	5.0	6.2	0.937	None	
SBR76-656Xb	Eliz. 12-1A	22376	2.0	2.7	94.0	1.3	5.2	6.5	.937	None	
SBR76-657Xa	Eliz. 12-1B	22307	.9	3.0	95.5	.6	2.3a	7.2		None	
SBR76-657Xb	Eliz. 12-1B	22308	.9	3.0	95.5	.6	2.4a	7.2		None	
SBR76-658Xa	Carbon 1-1	22309	2.1	2.5	94.6	.8	5.2	6.0	.947	None	
SBR76-658Xb	Carbon 1-1	22310	2.3	2.3	93.8	1.6	5.7	5.5	.950	None	
SBR76-659Xa	Carbon 1-2	22311	4.2	1.8	92.7	1.3	10.7	4.3	.932	None	
SBR76-659Xb	Carbon 1-2	22312	4.1	1.7	93.0	1.2	10.5	4.1	.932	None	
SBR76-660Xa	Carbon 2-1	22313	3.2	2.3	93.2	1.3	8.3	5.5	.942	None	
SBR76-660Xb	Carbon 2-1	22314	3.2	2.2	93.5	1.1	8.3	5.3	.941	None	
SBR76-661Xa	Carbon 2-2A	22315	6.1	3.0	89.0	1.9	15.6	7.2	.940	None	
SBR76-661Xb	Carbon 2-2A	22316	6.2	3.0	88.5	2.3	15.9	7.2	.941	None	
SBR76-662Xa	Carbon 2-2B	22317	2.7	3.5	92.7	1.1	6.9	8.4	.942	None	
SBR76-662Xb	Carbon 2-2B	22318	2.8	3.0	92.4	1.8	7.1	7.2	.942	None	
SBR76-663Xa	Carbon 2-2C	22319	5.9	2.5	90.0	1.6	15.0	6.0	.946	None	
SBR76-663Xb	Carbon 2-2C	22320	5.8	2.4	90.0	1.8	14.6	5.8	.945	None	
SBR76-664Xa	Carbon 3-1A	22321	2.5	2.4	94.3	.8	6.3	5.8	.940	None	
SBR76-664Xb	Carbon 3-1A	22322	2.5	2.4	94.0	1.1	6.3	5.8	.941	None	

See footnote at end of table.

Samples received July 7, 1976; assays made on air-dried samples

Laramie Energy Research Center, Laramie, Wyoming Illustration No. SBR-4823P Sheet 1 of 3 July 9, 1976

OIL-SHALE ASSAYS BY MODIFIED FISCHER RETORT METHOD

Special samples from the Bureau of Land Management, Denver

Sample number			Yield of product						Specific gravity of oil at 60°/60° F	Properties of spent shale	Remarks
			Weight percent				Gal per ton				
Laramie	Their	Run No.	Oil	Water	Spent shale	Gas + loss	Oil[1/]	Water		Tendency to coke	
SBR76-665Xa	Carbon 3-1B	22387	1.5	2.8	95.2	0.5	3.8a	6.7		None	
SBR76-665Xb	Carbon 3-1B	22388	1.5	2.8	93.7	2.0	3.9a	6.7		None	
SBR76-666Xa	Carbon 3-1C	22325	3.0	2.0	94.1	.9	7.6	4.8	0.943	None	
SBR76-666Xb	Carbon 3-1C	22326	3.1	1.9	94.0	1.0	7.8	4.6	.941	None	
SBR76-667Xa	Carbon 4-1A	22327	2.5	2.6	93.8	1.1	6.2	6.2	.947	None	
SBR76-667Xb	Carbon 4-1A	22328	2.7	2.5	93.8	1.0	6.8	6.0	.945	None	
SBR76-668Xa	Carbon 5-1A	22329	3.2	2.2	93.0	1.6	8.0	5.3	.956	None	
SBR76-668Xb	Carbon 5-1A	22330	3.1	2.0	93.3	1.6	7.9	4.8	.946	None	
SBR76-669Xa	Carbon 5-1B	22331	1.2	2.3	94.4	2.1	3.1a	5.5		None	
SBR76-669Xb	Carbon 5-1B	22332	1.4	2.9	94.7	1.0	3.7a	7.0		None	
SBR76-670Xa	Carbon 5-1C	22333	.8	3.0	95.0	1.2	2.1a	7.2		None	
SBR76-670Xb	Carbon 5-1C	22334	.7	2.9	95.1	1.3	1.8a	7.0		None	
SBR76-671Xa	Carbon 5-1D	22335	.6	3.9	94.1	1.4	1.5a	9.3		None	
SBR76-671Xb	Carbon 5-1D	22336	.4	3.8	94.4	1.4	1.1a	9.1		None	
SBR76-672Xa	Eliz. 11-1-2	22337	.0	5.6	93.0	1.4	No Oil	13.5		None	
SBR76-672Xb	Eliz. 11-1-2	22338	.0	5.6	93.6	.8	No Oil	13.4		None	

See footnote at end of table.

Samples received July 7, 1976; assays made on air-dried samples

Laramie Energy Research Center, Laramie, Wyoming Illustration No. SBR-4823P Sheet 2 of 3 July 9, 1976

OIL-SHALE ASSAYS BY MODIFIED FISCHER RETORT METHOD

Average Fischer Assay Results for Bureau of Land Management Samples

Sample number		Yield of product						Specific gravity of oil at 60°/60° F	Properties of spent shale	
		Weight percent				Gal per ton				
Laramie	Their	Oil	Water	Spent shale	Gas + loss	Oil 1/	Water		Tendency to coke	Remarks
SBR76-650X	Eliz. 5-1	0.7	3.4	95.4	0.5	1.8a	8.0		None	sec. 35, NWNW
SBR76-651X	Eliz. 7-1	.0	4.8	94.6	.6	No Oil	11.6		None	sec. 35, NESW
SBR76-652X	Eliz. 8-1	.0	5.9	93.1	1.0	No Oil	14.2		None	sec. 35, SESW
SBR76-653X	Eliz. 9-1	.0	5.8	93.5	.7	Trace	13.8		None	sec. 34, SESE
SBR76-654X	Eliz. 10-1	.1	3.8	95.4	.7	.1a	9.2		None	sec. 34, NESW
SBR76-655X	Eliz. 11-1-1	.0	5.0	94.2	.8	Trace	11.9		None	sec. 34, SWNW
SBR76-656X	Eliz. 12-1A	2.0	2.6	94.4	1.0	5.1	6.3	0.937	None	sec. 34, NENE
SBR76-657X	Eliz. 12-1B	.9	3.0	95.5	.6	2.4a	7.2		None	sec. 34, NENE
SBR76-658X	Carbon 1-1	2.2	2.4	94.2	1.2	5.5	5.8	.949	None	sec. 33, SWSE
SBR76-659X	Carbon 1-2	4.2	1.8	92.8	1.2	10.6	4.2	.932	None	sec. 33, SWSW
SBR76-660X	Carbon 2-1	3.2	2.2	93.4	1.2	8.3	5.4	.941	None	sec. 33, NWSW
SBR76-661X	Carbon 2-2A	6.2	3.0	88.8	2.0	15.8	7.2	.940	None	sec. 33, NWSW
SBR76-662X	Carbon 2-2B	2.8	3.2	92.6	1.4	7.0	7.8	.942	None	sec. 33, NWSW
SBR76-663X	Carbon 2-2C	5.8	2.5	90.0	1.7	14.8	5.9	.946	None	sec. 33, NWSW
SBR76-664X	Carbon 3-1A	2.5	2.4	94.2	.9	6.3	5.8	.940	None	sec. 33, SENW
SBR76-665X	Carbon 3-1B	1.5	2.8	94.4	1.3	3.9a	6.7		None	sec. 33, SENW
SBR76-666X	Carbon 3-1C	3.0	2.0	94.0	1.0	7.7	4.7	.942	None	sec. 33, SENW
SBR76-667X	Carbon 4-1A	2.6	2.6	93.8	1.0	6.5	6.1	.946	None	sec. 33, NENW
SBR76-668X	Carbon 5-1A	3.2	2.1	93.1	1.6	8.0	5.1	.951	None	sec. 32, NWNW
SBR76-669X	Carbon 5-1B	1.3	2.6	94.5	1.6	3.4a	6.3		None	sec. 32, NWNW
SBR76-670X	Carbon 5-1C	.8	3.0	95.0	1.2	1.9a	7.1		None	sec. 32, NWNW
SBR76-671X	Carbon 5-1D	.5	3.8	94.3	1.4	1.3a	9.2		None	sec. 32, NWNW
SBR76-672X	Eliz. 11-1-2	.0	5.6	93.3	1.1	No Oil	13.4		None	sec. 34, SWNE

Analyses supervised by:

Gregory A. Coates

Gregory A. Coates, Assay Lab Supervisor

1/ "a"--indicates specific gravity estimated as 0.92.

Samples received July 7, 1976; assays made on air-dried samples

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